Third Five-Year Review Report
for
Sola Optical USA, Inc.
Superfund Site
Sonoma County, California

September 23, 2010

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Date

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Acronyms & Abbreviations

ARARs	applicable or relevant and appropriate requirements
bgs	below ground surface
CalEPA	California Environmental Protection Agency
CCR	California Code of Regulations
CDM	Camp Dresser & McKee, Inc.
CZV	Carl Zeiss Vision, Inc.
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
COC	constituents of concern
CSDHS	County of Sonoma – Department of Health Services
CSPRMD	County of Sonoma – Permit and Resource Management Department
DWR	Department of Water Resources
DTSC	Department of Toxic Substances Control
1,1-DCA	1,1-dichloroethane
1,2-DCA	1,2-dichloroethane
1,1-DCE	1,1-dichloroethene
EHD	Environmental Health Division
EPA	United States Environmental Protection Agency
ESL	environmental screening level
FS	Feasibility Study
GWTS	groundwater extraction and treatment system
HCS	Harvest Christian School
HHRA	human health risk assessment
IC	institutional control
IRIS	Integrated Risk Information System
LFR	Levine Fricke, Inc.
MCL	maximum contaminant level
msl	mean sea level
µg/L	micrograms per liter
mg/kg	milligrams per kilogram
mg/L	milligrams per liter
MNA	monitored natural attenuation
ND	non-detect; not detected
NCP	National Contingency Plan
NPDES	National Pollution Discharge Elimination System
NPL	National Priority List

OSWER	Office of Solid Waste and Emergency Response
OEHHA	California EPA Office of Environmental Health Hazard Assessment
O&M	operation and maintenance
PRP	potentially responsible party
RI	Remedial Investigation
RNM	RNM Properties/RNM Cader, LLC
ROD	Record of Decision
RAO	Remedial Action Objectives
SARA	Superfund Amendments and Reauthorization Act
Site	Sola Optical USA, Inc. Superfund Site
Sola	Sola Optical USA, Inc.
TI	Technical Impracticability
PCE	tetrachloroethene
TBC	to be considered
tDCE	trans-1,2-dichloroethene
1,1,1-TCA	1,1,1-trichloroethane
1,1,2-TCA	1,1,2-trichloroethane
TCE	trichloroethene
UST	underground storage tank
VOC	volatile organic compound
Water Board	California Regional Water Quality Control Board – San Francisco Bay Region

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Executive Summary

The United States Environmental Protection Agency (EPA) has completed this Third Five-Year Review of the remedial action at the former Sola Optical USA, Inc. (Sola) Facility (Site), located in Petaluma, California, in Sonoma County. Sola Optical manufactured ophthalmic lenses from 1978 through 2001. The facility was comprised of one manufacturing building and an adjoining administration office building. The manufacturing process involved the use of 1,1,1-trichloroethane (1,1,1-TCA), acetone, and methanol. Six 1,000-gallon underground storage tanks (USTs) that stored solvents were located behind the north corner of the manufacturing building.

In 1985, the tanks and surrounding soil were removed. Confirmation samples analyzed for selected volatile organic compounds (VOCs) revealed the presence of acetone, ranging from 1.1 to 54 milligrams per kilogram (mg/kg) and 1,1-dichloroethene (1,1-DCE) detected at 0.010 mg/kg. Groundwater at the site was demonstrated to be contaminated with 1,1,1-TCA, 1,1-DCE, 1,1-dichloroethane (1,1-DCA), and methylene chloride. Active groundwater extraction and treatment remediation occurred at this site for eight years, from 1988 to 1997. In March 2007, EPA signed the Record of Decision (ROD) Amendment, which included the new remedy of monitored natural attenuation (MNA) and institutional controls (ICs).

In July 2007, three groundwater monitoring wells (W-22, W-25, and LF-2) and three extraction wells (E-3, E-5, and E-7) were abandoned. No additional wells have been installed on the Site.

The remedy at the Sola Site currently protects human health and the environment because the groundwater contamination has been reduced below drinking water standards (maximum contaminant levels [MCLs]) in all but a very limited area around one well, no exposure pathways to the remaining contamination exist, and no one is using the groundwater resource. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure long-term protectiveness:

- The well permitting restriction IC within the County of Sonoma – Permit and Resource Management Department (CSPRMD) Permits Plus system must be properly implemented to ensure the protectiveness of the remedy.

- Determine whether the restrictive covenant IC is required to protect human health in the short-term, and implement it if so.

Five-Year Review Summary Form

SITE IDENTIFICATION

Site name: Sola Optical USA, Inc. Superfund Site

EPA ID: CAD981171523 **CERCLIS ID :** CAD981171523

Region: IX **State:** CA **City/County:** Petaluma / Sonoma County

SITE STATUS

NPL status: ■ Final ❑ Deleted ❑ Other (specify) _____

Remediation status (choose all that apply): ■Operating ❑ Complete

Multiple OUs? ❑ YES ■ NO **Construction completion date:** August 4, 1992

Has site been put into reuse? ■ YES ❑ NO

REVIEW STATUS

Reviewing agency: ■ EPA ❑ State ❑ Tribe ❑ Other Federal Agency _____

Author name: Dante Rodriguez

Author title: Remedial Project Manager **Author affiliation:** EPA Region IX

Review period: March 1 – April 15, 2010

Date(s) of site inspection: March 17, 2010

Type of review: ❑Statutory

■ Policy ❑ Post-SARA ❑ Pre-SARA ❑ NPL-Removal only

❑ Non-NPL Remedial Action Site ❑ NPL State/Tribe-lead

■ Regional Discretion

Review number: ❑ 1 (first) ❑ 2 (second) ■ 3 (third) ❑ Other (specify)

Triggering action:

❑ Actual RA On-site Construction at OU __

❑ Actual RA

■ Previous Five-Year Review Report 2005

❑ Construction Completion

❑ Other (specify) _____

Triggering action date: September 2005

Due date (five years after triggering action date): September 2010

Issues:

The following issues were noted during the Third Five-Year Review:

Issue #1

Although no additional wells have been installed on the Site since 2005, the well permitting restriction IC is not properly in place, which impacts the protectiveness of the 2007 ROD Amendment remedy.

Issue #2

The restrictive covenant IC has not yet been implemented.

Recommendations and Follow-up Actions:

This section presents the recommendations from this Third Five-Year Review.

1. The County of Sonoma needs to be contacted to ensure that the Permits Plus system is corrected so that the notice regarding the Site well installation restriction comes up when a well permit application is entered into the system.

2. Determine whether the restrictive covenant IC is required to protect human health in the short-term, and implement it, if so.

Protectiveness Statement:

The remedy at the Sola Site currently protects human health and the environment because the groundwater contamination has been reduced below drinking water standards (MCLs) in all but a very limited area around one well, no exposure pathways to the remaining contamination exist, and no one is using the groundwater resource. However, in order for the remedy to be protective in the long-term, the following actions need to be taken:

- The well permitting restriction IC within the CSPRMD Permits Plus system must be properly implemented to ensure the protectiveness of the remedy.

- Determine whether the restrictive covenant IC is required to protect human health in the short-term, and implement it if so.

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Section 1
Introduction

The United States Environmental Protection Agency (EPA) conducted the Third Five-Year Review of the remedial action implemented at the Sola Optical USA, Inc. (Sola) Superfund Site (Site) located in the City of Petaluma in Sonoma County, California (Figure 1). This document, prepared in accordance with EPA's *Comprehensive Five-Year Review Guidance, EPA 540-R-01-007* (EPA, 2001), presents the results of the Third Five-Year Review conducted for the Site.

EPA is preparing this five-year review consistent with the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA) and the National Oil and Hazardous Substances Pollution Contingency Plan (NCP). CERCLA Section 121(c), as amended, states:

> *If the President selects a remedial action that results in any hazardous substances, pollutants, or contaminants remaining at the Site, the President shall review such remedial action no less often than each 5 years after the initiation of such remedial action to assure that human health and the environment are being protected by the remedial action being implemented. In addition, if upon such review it is the judgment of the President that action is appropriate at such site in accordance with section [104] or [106], the President shall take or require such action. The President shall report to the Congress a list of facilities for which such review is required, the results of all such reviews, and any actions taken as a result of such reviews.*

The NCP part 300.430(f)(4)(ii) of the Code of Federal Regulations (CFR) states:

> *If a remedial action is selected that results in hazardous substances, pollutants, or contaminants remaining at the Site above levels that allow for unlimited use and unrestricted exposure, the lead agency shall review such action no less often than every five years after the initiation of the selected remedial action.*

Consequently, this Five-Year Review is considered a policy review because clean-up levels have not yet been achieved, and until they are, hazardous substances, pollutants, or contaminants remain at the Site above target clean-up levels that allow for unrestricted use and unlimited exposure.

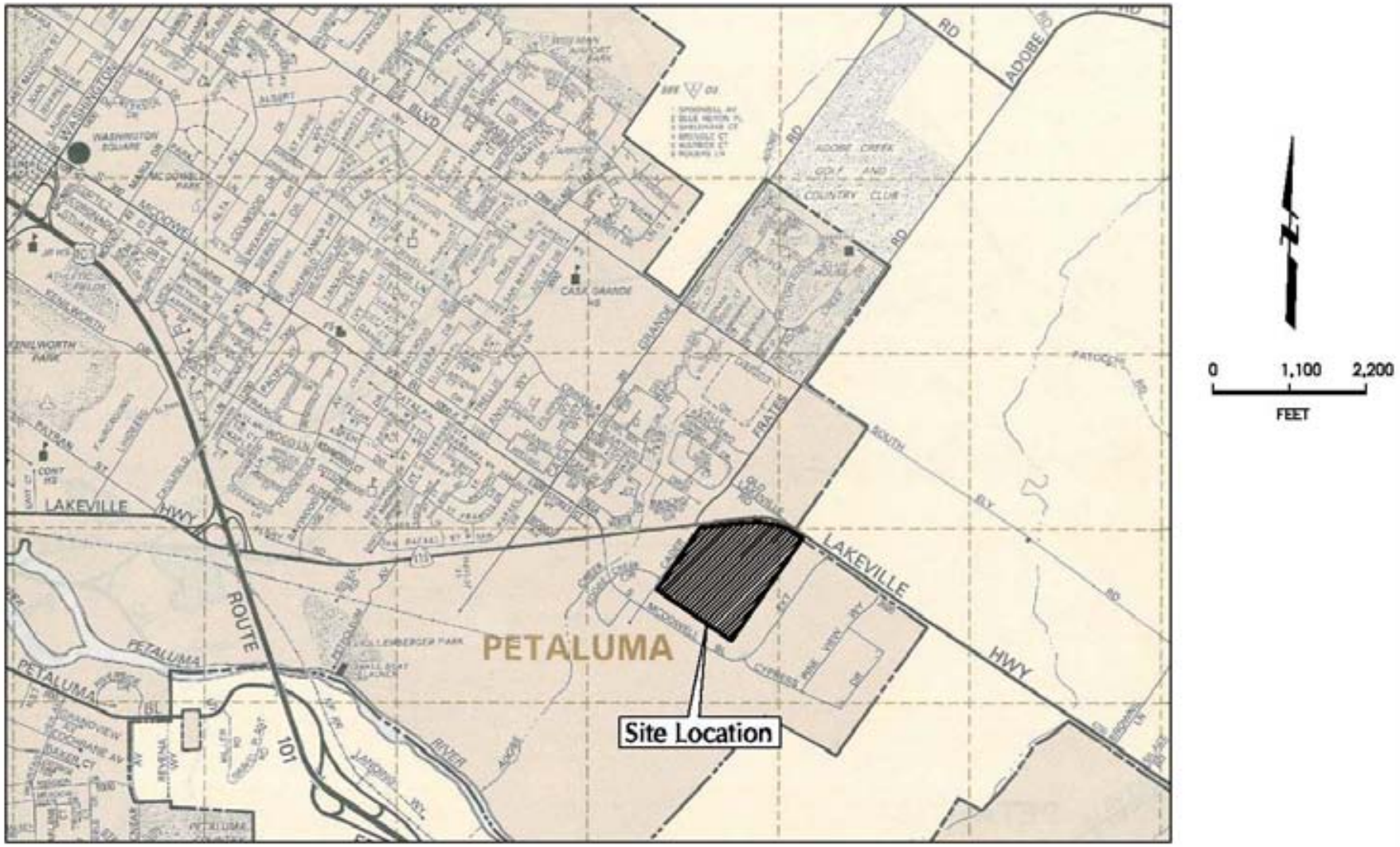


Figure 1
Site Vicinity Map
Sola Optical USA, Inc.
Third Five Year Review Report
Petaluma, California

CDM

Section 2
Site Chronology

Table 2-1 provides a chronology of events at the Site.

Table 2-1
Chronology of Site Events
Sola Optical USA, Inc., Sonoma County, CA

Date	Event
1978-2001	Sola operates as ophthalmic lens manufacturing facility.
1978-1985	Six 1,000-gallon underground storage tanks (USTs) are used to store 1,1,1-trichloroethane (1,1,1-TCA), acetone, and methanol.
1982	Volatile organic compounds (VOCs) are detected in shallow groundwater in immediate vicinity of USTs.
1983	The California Regional Water Quality Control Board – San Francisco Bay Region (Water Board) orders a groundwater investigation.
July 1985	Sola removes six 1,000-gallon USTs.
July 1986	Sola conducts soil gas and soil boring investigation. Maximum detection of 150 milligrams per liter (mg/L) 1,1,1-TCA in soil gas.
November 1986	Trace concentrations of VOCs are detected in City of Petaluma Station 5 municipal water supply well, located approximately 300 feet downgradient of the Site.
April 1987	Water Board issues Site Clean Up Order (Docket # 87-038) requiring Sola to construct a groundwater extraction and treatment system (GWTS).
May 1987	Water Board refers site to EPA for inclusion on the National Priorities List (NPL).
May 1987	EPA Special Notice Letter proposes additional Remedial Investigation (RI) activities and preparation of a Feasibility Study (FS) for the Site.
October 1987	Sola installs a GWTS, which is fully operational by August 1988.
June 1988	City of Petaluma ceases operation of Station 5 well.
October 1989	Sola and City of Petaluma enter written agreement to cease operations at Station 5 well until such pumping would no longer have the potential to impede any remedial measures at the Site.
October 1989	EPA issues administrative order (Docket # 89-22) for RI/FS; additional soil and soil gas sampling conducted under EPA oversight.
February 1990	Site was placed on the NPL.
April 1990	Use of Stero's private water supply well discontinues; Sola removes pumping system and agrees to pay for municipal water supply.
December 1990	Sola submits RI.
June 1991	Sola submits FS with detailed evaluation of enhancements to current GWTS remedy, i.e., installing two additional shallow extraction wells and converting two deep monitoring wells into extraction wells.
September 1991	EPA issued a Record of Decision (ROD), selecting expansion and continued operation of the existing GWTS system, with off-site disposal of treated effluent. Concludes that soils do not pose unacceptable risk.
January 1992	EPA issues Administrative Order (Docket # 92-07) for Remedial Design/Remedial Action.

Table 2-1 (Continued)

Date	Event
February 1992	Remedial Design/Remedial Action Work Plan submitted to EPA. Specified enhanced GWTS system.
July 1992	Enhanced extraction system started. This included two new shallow monitoring wells and the conversion of two deep monitoring wells into extraction wells.
August 1992	Construction complete and interim closeout report signed: eight extraction wells, liquid phase carbon treatment.
January 1993	Public Health Assessment Report concludes no apparent public health hazard at the Site because contaminated groundwater is not currently a source of drinking water. Future exposures were considered unlikely if the groundwater extraction system reduces concentrations to levels below health concerns.
November 1996	Sola submits request for a Technical Impracticability (TI) Waiver because the California Department of Public Health maximum contaminant levels (MCLs) had not been achieved throughout the Site with active groundwater extraction after eight years of pumping.
March 1997	EPA stated that a TI waiver could not be determined without additional information, including turning off the extraction wells and treatment system for two quarters and evaluating potential rebound during quarterly monitoring for six months. GWTS shut down at this time.
November 1997	No rebound noted during end of 6-month test period. Sola abandons 17 groundwater monitoring wells and 4 piezometers that have been at non-detect (ND) levels or below the MCLs and decreases monitoring frequency from quarterly to semiannual.
September 2000	First Five-Year Review and site inspection.
April-May 2001	Abandonment of 34 monitoring, extraction and piezometers at site
April 2001	Extraction wells E-5, E-6, E-7, and E-11 were decommissioned in preparation for proposed development of adjacent property (pumps pulled and wellhead piping removed).
November 6, 2001 to January 13, 2002	Dismantling of GWTS system completed. Extraction wells E-1, E-2, E-3, E-4, and E-10 were also decommissioned at this time.
May 2001	MW-19 destroyed to accommodate site development. E-7 added to monitoring program as a replacement well.
September 2002	EPA requests a work plan to implement monitored natural attenuation (MNA) at the Site.
October 2002	Sola submits Work Plan to implement MNA (Levine Fricke [LFR], 2002b). Also submits request to abandon and destroy six former monitoring and extraction wells.
December 2002	EPA approves the MNA Evaluation Report/Work Plan. Groundwater monitoring plan further modified in January 2003.
April 2004	Six groundwater monitoring and former extraction wells located at the Site were abandoned (W-14, LF-25, LF-26, E-6, E-10, and E-11), under Destruction Permit # 4245, County of Sonoma – Department of Health Services (CSDHS).
June 2005	Sola submits *Groundwater Monitoring and Additional Site Activities Report* (LFR, 2005). This report included data from groundwater monitoring events from May 2003 through May 2005.
September 2005	Second Five-Year Review and site inspection (EPA, 2005a).

Table 2-1 (Continued)

Date	Event
August 2006	Sola submits *Groundwater Monitoring and Additional Site Activities Report* (LFR, 2006). This report included data from groundwater monitoring events in October 2005 and June 2006. This report also included a request to abandon three groundwater monitoring wells (W-22, W-25, and LF-2) and three extraction wells (E-3, E-5, and E-7).
January 2007	EPA submits Proposed Plan to public entitled *EPA Proposes Amending the Clean-up Plan for Contaminated Groundwater, Sola Optical USA, Inc. Superfund Site* (EPA, 2007a).
February 2007	Sola submits *Groundwater Monitoring and Additional Site Activities Report* (LFR, 2007a). This report included data from the groundwater monitoring event in October 2006 and also included a request to abandon three groundwater monitoring wells (W-22, W-25, and LF-2) and three extraction wells (E-3, E-5, and E-7).
March 2007	EPA issues a ROD Amendment, selecting MNA to achieve groundwater clean-up standards, institutional controls (ICs) to protect against inappropriate use of the contaminated groundwater until the clean-up standards are achieved, and monitoring of both of the remedy components until clean-up standards are achieved and sustained. The goal for MNA is aquifer restoration (EPA, 2007b).
August 2007	A Conditional Use Permit application is submitted to the City of Petaluma – Community Development Department to relocate the Harvest Christian School (HCS) to 1500 Cader Lane (HCS, 2007). Sola submits report regarding the well abandonment activities in July 2007 (LFR, 2007c).
September 2008	Sola submits *Groundwater Monitoring and Additional Site Activities Report* (LFR, 2008a). This report included data from the groundwater monitoring event in April 2008. This report also described the work associated with the conversion of the W-27 stove-pipe well box to a flush mounted well box. This work was conducted at the request of RNM Properties, which is an agent to RNM Cader, LLC (RNM), the current owners of the auxiliary 11 acres, in order for them to install a parking lot in the area of the well as part of site development activities (LFR, 2008a).
November 2008	The CSDHS submits a *Notice of Potential Groundwater Contamination* letter to constituents who own property within ¼-mile of the Sola Site (CSDHS-EHD, 2008).
December 2008	Sola submits *Groundwater Monitoring Report* (LFR, 2008b). This report included data from the groundwater monitoring event in September 2008.
September 2009	Sola submits *Groundwater Monitoring Report* (LFR/Arcadis, 2009). This report included data from the groundwater monitoring event in May 2009.
On-going	Semi-annual groundwater monitoring of one remaining shallow groundwater wells. The next monitoring report is due in May-June 2010.

Section 3
Background

3.1 Physical Characteristics

The Site is located in Sonoma County, in the southeastern edge of the City of Petaluma, California, just east of Lakeville Highway's intersection with Interstate Highway 101, as shown on Figure 1. Adobe Creek lies 0.3 mile west of the Site and flows into the Petaluma River one mile from the Site. The Site is essentially flat, and a manufacturing building and adjoining administration office building occupy the property. Six USTs were formerly located behind the north corner of the manufacturing part of the facility. The Site building is occupied by three companies, which access the main facility building and the loading docks. There is a fence located along the eastern Site boundary. Since 2005, an asphalt parking lot and four building pads with the associated below grade infrastructure (i.e., electrical and plumbing) have been constructed on the auxiliary 11 acre lot.

The topography of the area, including the Site, gently slopes 50 feet per mile from low hills in the east towards the Petaluma River, located approximately one mile southwest of the Sola building. Adobe Creek, located 0.3 mile west of the Sola building, runs north-south and flows intermittently into the Petaluma River one mile south from the Site. .

Geologic investigations indicate that the depositional sediments at the Site consist of a complex sequence of alluvial deposits consisting of interbedded clays, silts, and sands, with lesser amounts of gravel. At depths of approximately 80 to 100 feet below ground surface (bgs), thicker clay intervals are present, which appear to be relatively continuous over distances of hundreds of feet. Interbedded within the clay are silt, sand, and gravel layers of various thicknesses. These deeper sediments probably represent complex alluvial and estuarine depositional environments (LFR, 1989).

Since October 2005, groundwater in the shallow sediments is generally encountered from 6 to 18.5 feet above mean sea level (msl). The aquifer is unconfined and the groundwater flows south/southwesterly towards the Petaluma River, most likely the point of discharge. Natural recharge occurs at the base of the foothills to the north/northeast. The shallow aquifer extends to approximately 30 feet below msl and has been classified by EPA as a Class IIa drinking water source aquifer. Below the shallow aquifer, the intermediate aquifer is approximately 30 to 60 feet below msl. The deep aquifer is from approximately 60 to 100 feet below msl, the deeper aquifer from approximately 100 to 200 feet below msl, and the deepest aquifer is greater than 200 feet below msl (LFR, 1990).

3.2 Land and Resource Use

The 35-acre Sola property is zoned for industrial use. Land-use in the surrounding area is industrial, commercial, residential, and undeveloped land (Figure 1). The adjacent property to the west of the Site was previously owned by Stero Company, a manufacturer of dishwashers. There are residential subdivisions to the north and

northwest of the Site, approximately 200 feet away. Property east of the Site is used for office space and the Harvest Christian School.

Approximately 11 previously undeveloped acres (889,060 square feet) in the southwest portion of the Site were purchased by RNM for development. An asphalt parking lot and four building pads with the associated below grade infrastructure (i.e., electrical and plumbing) have been constructed on this lot since the previous five-year review. The remaining 24 acres of the Sola property, including the buildings, were sold to Kland, LLC in 2002. Buildings on the Site facility parcel include the original manufacturing building, an adjoining administration office building, and a parking lot surrounding the buildings. Three commercial tenants currently occupy the Site building: Petaluma Poultry, Reynolds Packaging, and Scott Laboratories. Petaluma Poultry conducts sales and distribution of poultry; Reynolds Packaging conducts storage and distribution of food packaging materials; and Scott Laboratories conducts manufacturing and finishing of cork for the wine industry.

The City of Petaluma uses the unconfined aquifer in the area as a drinking water source. In the vicinity of the Site, one active City of Petaluma municipal water supply well (Station #5, screened from 180 to 512 feet bgs) and two private wells (Stero industrial well and Crandell residential well) were previously used. In addition, one City of Petaluma well (screened from 60 to 280 feet bgs) was installed at the Site but never used. All of these wells have been shut down and/or abandoned

- In 1989, Sola entered into a written agreement with the City of Petaluma whereby the City agreed to discontinue using the Station #5 well and to refrain from using the newly installed on-site municipal well, for the stated purpose of ensuring that Sola's groundwater clean-up operation (at that time comprising groundwater extraction and ex-situ treatment) would not be disrupted by local pumping effects. The newer City of Petaluma well that was screened from 60 to 280 feet bgs was destroyed in 2001 (LFR, 2001). Sola alsoreached an agreement with the City to abandon and replace the Station #5 well with another comparable water supply well (LFR, 2001).

- The two private wells (Stero and Crandell wells) were shut down in 1990.

- The Crandell well was permanently abandoned, and the pumping apparatus was removed from the Stero well (EPA, 2005a).

3.3 History of Contamination

Sola manufactured ophthalmic lenses from 1978 through 2001. The facility consisted of one manufacturing building and an adjoining administration office building. The manufacturing process involved the injection of a catalyzed, thermosetting resin into a cavity between polished glass molds. The mold assembly was then placed in an air oven to cure the resin. The assembly was removed from the oven and subsequently put through a cleaning process before the production was repeated. The six USTs located behind the rear north corner of the manufacturing part of the facility were used to store solvents such as 1,1,1-TCA, acetone, and methanol.

In May 1982, Sola found low concentrations of VOC contamination in the groundwater beneath the Site, near the six USTs. In 1983, the Water Board directed Sola to investigate the contamination and 1,1-dichloroethane (1,1-DCA), 1,1-dichloroethene (1,1-DCE), methylene chloride, and 1,1,1-TCA were identified in the groundwater. In July 1985, Sola excavated and removed the six USTs. When the tanks were removed, there were no signs of leakage from the tanks; however, observations of the tank fill pipes and surrounding backfill showed staining on the pipes and in the adjacent backfill (LFR, 1990). It was concluded that the groundwater contamination might be a result of accidental spillage adjacent to, or leakage from, the fill pipes.

The tank removal included excavation of gravel backfill materials and three to five feet of native soil from the sides and bottom of the excavation pit. Confirmation sampling identified the presence of three contaminants: acetone, 1,1-DCE, and trans-1,2-dichloroethene (tDCE). Based on these findings, an additional two feet of soil was excavated from the eastern wall of the former tank area. Further confirmation sampling demonstrated the presence of VOCs, including acetone. No additional excavation was performed (LFR, 1990).

In July 1986, soil gas samples were collected from 40 locations, ranging from three to five feet bgs, to determine if VOCs were migrating from shallow groundwater and to aid in selection of locations for groundwater monitoring and extraction wells. Chemicals detected in the soil gas included: chloroform, carbon tetrachloride, 1,1-DCA, 1,1-DCE, tetrachloroethene (PCE), and 1,1,1-TCA. Maximum concentrations were found approximately 70 feet downgradient from the location of the former USTs (CH2M Hill, 1991).

In 1987, Sola constructed and began operating a GWTS. Treated groundwater was discharged under a National Pollution Discharge Elimination System (NPDES) Permit from the Water Board into Adobe Creek northwest of the Site. The extraction system operated from 1988 through 1997. The site was placed on the NPL in 1990 (EPA, 2000).

3.4 Basis for Taking Action

Although remedial actions – interim pumping and treatment of groundwater, and removal of tanks and contaminated soil – have reduced Site risks, groundwater beneath the Site still exceeds drinking water standards, reducing its full beneficial use as drinking water. Twelve chemicals of potential concern were identified in the 1991 ROD: acetone, butanone, 1,1-DCA, 1,2-dichloroethane (1,2-DCA), 1,1-DCE, Freon 113, 4-methyl-2-pentanone, PCE, toluene, 1,1,1-TCA, 1,1,2-trichloroethane (1,1,2-TCA), and trichloroethene (TCE). Contamination was found in the soil (acetone ranging up to 54 mg/kg and 1,1-DCE at 0.051 mg/kg), and in the groundwater (primarily 1,1-DCA, 1,1-DCE, 1,1,1-TCA, and Freon-113). The highest contaminant concentration in groundwater was 1,1-DCE (3,300 micrograms per liter [µg/L]) detected in shallow well W-14 located downgradient of the former UST area. The wells on the downgradient edge of the Site indicated that the lateral extent of the VOC contamination within the Sola property was at or below the clean-up standards (EPA, 1991).

The risk assessment presented in the ROD indicated an excess lifetime cancer risk based on use of on-site contaminated groundwater for drinking water of $1x10^{-4}$ (1 person out of 10,000 people), primarily from 1,1 DCE. The non-carcinogenic risk estimate for contaminated groundwater indicated that no adverse noncarcinogenic health effects are expected.

The ecological assessment identified Adobe Creek as the closest surface water body to the Site and as a site of a local project to reintroduce anadromous steelhead trout to the creek. However, water quality samples from groundwater monitoring wells installed between the Sola property and Adobe Creek have not detected any contaminants, indicating that discharge of contaminants to surface water has not occurred. In addition, contaminants detected in groundwater at the Site are below their corresponding federal surface water quality criteria for the protection of aquatic life.

Section 4
Remedial Actions

This section summarizes the selected remedial actions, remedy implementation, and operation and maintenance (O&M) of remedial systems.

4.1 Remedy Selection

The ROD for the Site was signed on September 27, 1991 (EPA, 1991). The Remedial Action Objective (RAO) is to restore groundwater to its beneficial use, which is drinking water. The selected site cleanup remedy consisted of the following elements:

- Groundwater monitoring to assure capture of contaminated groundwater and to demonstrate restoration of groundwater to cleanup standards throughout the aquifer
- Operation of existing extraction wells (8)
- Construction and operation of two additional shallow extraction wells
- Conversion of monitoring wells LF-13 and LF-17 to deep extraction wells
- Construction and operation of additional piping for the new and converted wells
- On-site treatment and discharge off-site or discharge to the City of Petaluma sewage treatment system

The enhanced GWTS, which began operating in 1992, was expected to restore the shallow groundwater to clean-up standards in 15 to 20 years. The system's deep extraction wells were needed to prevent further migration of contaminants into the deeper portion of the aquifer. The remedy included constructing a carbon filtration system at the facility to treat the extracted groundwater. The treated water was discharged off-site to Adobe Creek (EPA, 1991). The groundwater cleanup standards were set at state or federally promulgated drinking water standards, known as MCLs. The applicable drinking water standards and the MCLs listed in the ROD are shown in Table 4-1.

Table 4-1
ROD-Specified MCLs and Drinking Water Standards
Sola Optical USA, Inc., Sonoma County, CA

Chemical	Drinking Water Standard (µg/L)		RAO (µg/L)
	State	Federal	
1,1-DCE	6	7	6
1,1-DCA	5	NE	5
1,1,1-TCA	200	200	200
Freon 113	1,200	NE	1,200

NE = none established

In 1997, the groundwater extraction system was turned off. After two years, the groundwater extraction system was decommissioned and a number of the monitoring wells and piezometers were destroyed. Based on the groundwater monitoring data during this time, Sola requested that EPA consider MNA as a final remedy (LFR, 2001).

The 2007 ROD Amendment was signed on March 30, 2007 and modified the previously selected remedy for the Site (EPA, 2007b). The 2007 ROD Amendment addressed the two issues that prompted the remedy change: 1) groundwater clean-up, and 2) ICs. The new remedy included in the 2007 ROD Amendment includes the following (EPA, 2007b):

- MNA to achieve groundwater clean-up standards
- ICs to protect against inappropriate use of the contaminated groundwater until the clean-up standards are achieved
- Monitoring of both of the remedy components until clean-up standards are achieved and sustained.

The 2007 ROD Amendment did not change the RAOs stated in the original ROD to restore groundwater to its beneficial use, which is drinking water.

4.2 Remedy Implementation

In March 2007, EPA signed the ROD Amendment that included the additional remedy of MNA and ICs to achieve and sustain clean-up standards at the Site.

Monitored Natural Attenuation

Since 2005, Sola has continued groundwater monitoring with semi-annual sampling performed from June 2006 through December 2009. The groundwater sampling results from these events are discussed in Section 6.

In July 2007, three groundwater monitoring wells (W-22, W-25, and LF-2) and three extraction wells (E-3, E-5, and E-7) were abandoned. In accordance with the 2007 ROD Amendment, no additional wells have been installed on the Site.

Institutional Controls

ICs are non-engineering methods by which access to contaminated environmental media is restricted.

The 1991 ROD did not include ICs as part of the remedy (EPA, 1991). The ROD evaluated the need for ICs and concluded that none were necessary, on the basis that groundwater at the Site would soon be cleaned up to federal and state groundwater standards, rendering it available for domestic uses.

The Second Five-Year Review report, however, determined that ICs would address an existing risk to human health and the environment during the clean-up period (EPA, 2005a). Accordingly, the 2007 ROD Amendment added a requirement that ICs be implemented to protect against inappropriate use of the contaminated groundwater until the clean-up standards are achieved. The primary IC selected for the Site is a restrictive covenant, a type of proprietary control that is signed by the property owner and recorded with a county recorder's office (EPA, 2007b). The objective of the restriction is to prevent use of the groundwater that could result in unacceptable exposure of humans or the environment to contaminants. The restrictive covenant has not yet been implemented.

The 2007 ROD Amendment includes an additional IC, which involves the local well permitting process. The County of Sonoma – Permit and Resource Management Department (CSPRMD) is responsible for issuing all well installation permits (EPA, 2007b). The CSPRMD has a computerized system called Permits Plus that is used to maintain information about properties in Sonoma County (EPA, 2007b). As described in the 2007 ROD Amendment, EPA requested that the CSPRMD place a note within the Permits Plus system regarding the Site parcel that lies directly above the contaminated groundwater. This note would indicate that the parcel is part of a Superfund site and that well permits should not be issued before consulting with the CSPRMD and EPA. If anyone requests a permit for the Sola Site parcel, this note would appear within the Permits Plus system and the CSPRMD would review the permit request within the context of the Site requirements.

4.3 System Operations/ O&M

O&M for the MNA remedy consists of conducting semi-annual sampling. Since 2005, LFR/Arcadis have conducted groundwater monitoring events on a semi-annual and annual basis on behalf of Sola. In April 2010, LFR/Arcadis reported in an email that the Site annual O&M costs are approximately $14,500/year for the groundwater monitoring (Roth, 2010).

Section 5
Progress Since the Last Five-Year Review

The conclusions and recommendations made in the Second Five-Year Review are provided below.

5.1 2005 Five-Year Review Protectiveness Statement

From the Second Five-Year Review, the following statements were made regarding the protectiveness of the selected remedy for the Site:

> *"The remedy at the Sola Site currently protects human health and the environment because the groundwater contamination has been reduced below drinking water standards (MCLs) in all but a very limited area around one well, and no exposure pathways to the remaining contamination exist. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure long-term protectiveness:*
>
> - *EPA must identify and select institutional controls in a decision document, then monitor the effectiveness of these controls that will be relied upon to prevent use of the groundwater that still exceeds the clean-up standard.*
> - *The groundwater clean-up standard for 1,1-DCA must be attained in well W-27."*

5.2 Status of 2005 Five-Year Review Issues

Table 5-1
Actions Taken Since the Second Five-Year Review
Sola Optical USA, Inc., Sonoma County, CA

Issues from Previous Review	Recommendations/ Follow-Up Actions	Party Responsible	Milestone Date
The 1,1-DCA concentration in well W-27 remains above the MCL.	MNA performance data should continue to be reviewed and enhancements to the MNA system should be assessed.	Sola	Spring 2006
	Action Taken and Outcome Since 2005, Sola has continued MNA performance monitoring with semi-annual groundwater sampling performed from June 2006 through December 2009. In February 2007, Sola proposed no enhancements to the MNA system, rather proposed abandoning 3 monitoring and three former extraction wells. EPA approved this change in June 2007. In July 2007, three groundwater monitoring wells (W-22, W-25, and LF-2) and three former extraction wells (E-3, E-5, and E-7) were abandoned. No additional wells have been installed onsite.		***Date of Action*** June 2006 through December 2009

Table 5-1 (Continued)

Issues from Previous Review	Recommendations/ Follow-Up Actions	Party Responsible	Milestone Date
MNA had been proposed and implemented as an interim measure at the Site, but the ROD has not been amended yet to reflect the use of MNA to achieve the remaining clean-up needed.	After assessing possible enhancements to the MNA system, a ROD Amendment or Explanation of Significant Differences should be prepared to reflect any remedy change.	EPA	Autumn 2006
	Action Taken and Outcome In March 2007, EPA signed the ROD Amendment which included the new remedy of MNA to achieve and sustain clean-up standards at the Site. The need for enhancements to the MNA system was considered but no enhancements were recommended. Instead, the removal of six wells from the monitoring network was recommended.		***Date of Action*** March 2007
The 1991 ROD did not include any ICs and groundwater contamination was still present onsite.	ICs should be identified and selected in a ROD Amendment to limit the use of groundwater at the Site until clean-up goals are achieved.	EPA	Autumn 2006
	Action Taken and Outcome The ROD Amendment signed in March 2007 included ICs to limit the use of groundwater at the Site until clean-up goals are achieved.		***Date of Action*** March 2007

Section 6
Five-Year Review Process

The following sections discuss the Five-Year Review data gathering process and findings.

6.1 Administrative Components

This Third Five-Year Review for the Sola Site was led by Dante Rodriguez, the EPA Remedial Project Manager for the Site. The five-year review consisted of community notification, document review, data review, institutional controls review, human risk assessment, and site inspection. This work was initiated on February 23, 2010, and extended through June 2010.

6.2 Community Notification and Involvement

For this Five-Year Review, EPA published a public notice in the Petaluma Argus Carrier on April 15, 2010 announcing the beginning of the five year review process. No responses to the public notice were received. Following the release of the third Five-Year Review, EPA will produce and distribute a fact sheet to the community near the Site. The fact sheet will summarize the findings of the Five-Year Review and instructions on how to access a copy of the review. The report will also be placed in the local information repository near the Site.

6.3 Document Review

As part of the Third Five-Year Review for the Sola Site, documents relevant to the Site since 2005 were reviewed (Appendix B). Documents were chosen for review focusing primarily on actions that have occurred during the past five years, but ranged in publication date from 1989 to the present. Appendix B provides a list of the reviewed documents. The most significant documents reviewed were the groundwater monitoring reports. Based on these documents, the ensuing sections describe the findings of this Five-Year Review.

6.4 Data Review

The following sections describe the findings from the periodic monitoring and reporting, documented in the groundwater monitoring reports that were reviewed.

Performance Monitoring Program

Table 6-1 summarizes the monitoring schedule during the past five years as stated in the groundwater monitoring reports.

Table 6-1
Depth to Groundwater and VOC Monitoring Since October 2005
Sola Optical USA, Inc., Sonoma County, CA

Date	Monitoring Wells									
	W-22	W-25	W-27	LF-2	E-1	E-2	E-3	E-4	E-5	E-7
10/20/2005	●○	●○	●○	●○	●	●	●○	●	●○	●○
06/06/2006	●	●○	●○	●	●	●	●○	●	●○	●
10/26/2006	●○	●○	●○	●○	●	●	●○	●	●○	●○
04/11/2007	●	●○	●○	●	●	●	●○	●	●○	●
07/3-5/2007	*	*		*			*		*	*
10/19/2007			●○		●	●		●		
04/04/2008			●○[a]		●	●		●		
09/29/2008			●○		●	●		●		
05/15/2009			●○		●	●		●		
12/30/2009			●○		●	●		●		

Notes:
● = Groundwater Elevation
○ = Groundwater sample collected and analyzed for VOCs
* = W-22, W-25, LF-2, E-3, E-5, and E-7 were destroyed in July 2007.
a = On October 31, 2007, the stovepipe well box was replaced with a flush-mounted well box. The well casing was cut and finished several inches below grade.

In 2005, 2006, and early 2007, ten wells were monitored for groundwater elevation semi-annually, seven wells were sampled for VOCs annually, and four wells were sampled for VOCs semi-annually. In July 2007, three groundwater monitoring wells (W-22, W-25, and LF-2) and three extraction wells (E-3, E-5, and E-7) were destroyed and sealed in accordance with Department of Water Resources (DWR) guidelines (LFR, 2007b). Sampling had shown that VOC concentrations in these wells had been consistently below clean-up standards. The well destruction was performed under CSDHS – Environmental Health Division (EHD) permit number 05582 HMW. Figure 2 shows the status of the monitoring wells in 2010. No intermediate or deep wells remain; all remaining wells are shallow. One or more of the remaining extraction wells may be used for future sampling if the need is identified. Since October 2007, the remaining four wells have been monitored for groundwater elevation and one of them (W-27) continues to be monitored for VOCs.

Elevation and Flow Directions

Since May 2005, groundwater at the Site is encountered at approximately 6 to 18.5 feet above msl. The horizontal component of groundwater flow at the Site is to the southwest towards the Petaluma River.

In the past five years, no pumping has occurred at the Site. Groundwater elevations at the Site have not changed significantly. Table 6-2 shows the range of groundwater elevations for the monitoring wells since October 2005.

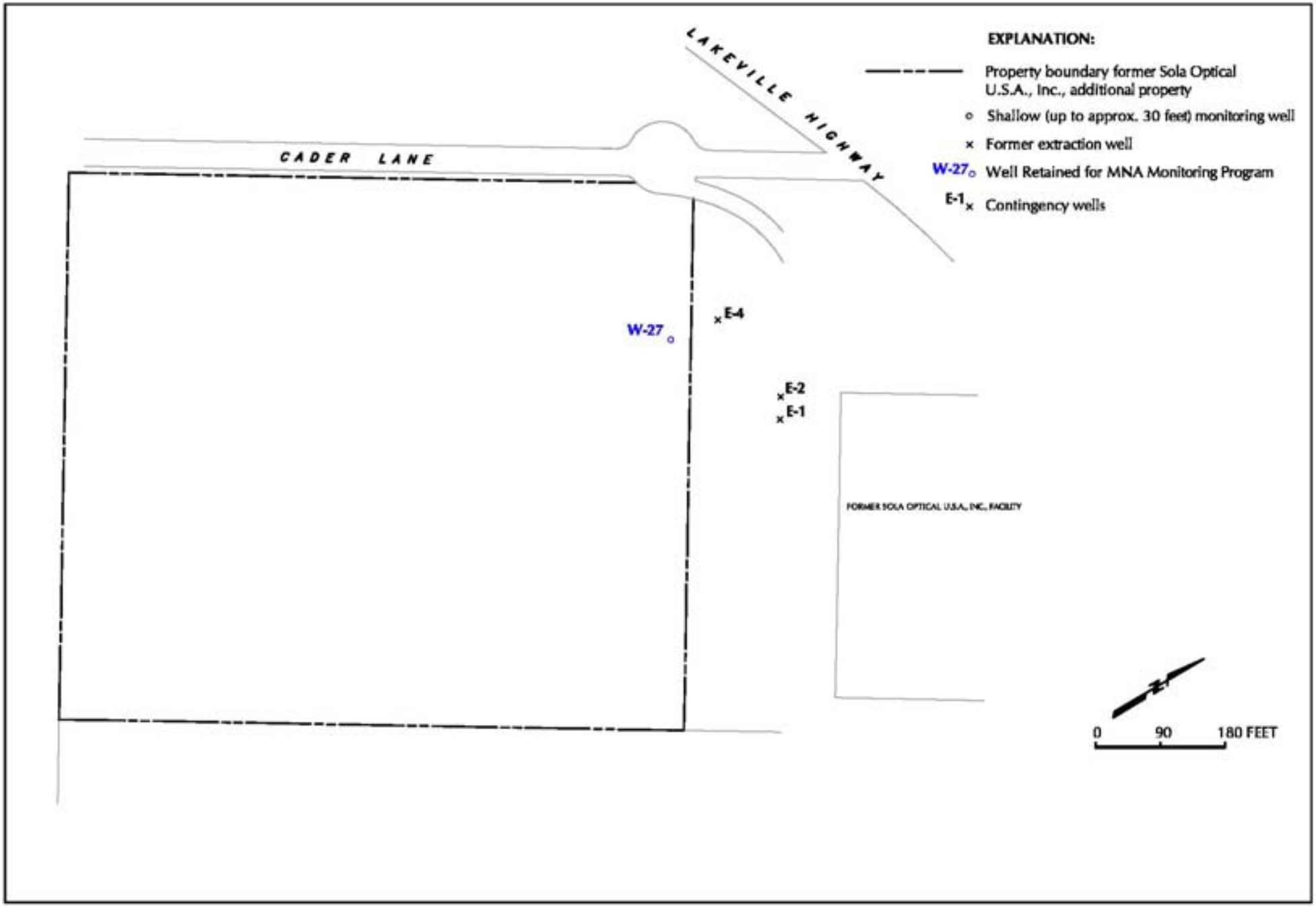


Figure 2
Monitoring Well Locations
Sola Optical USA, Inc.
Third Five Year Review Report
Petaluma, California

CDM

Table 6-2
Shallow Aquifer Groundwater Elevation Since October 2005
Sola Optical USA, Inc., Sonoma County, CA

Year	Groundwater Elevation (Well) (feet above msl)
October 2005	15.39 (W-22) to 19.31 (E-2)
June 2006	17.12 (W-22) to 21.84 (E-2)
October 2006	15.88 (W-22) to 20.40 (E-2)
April 2007	16.87 (W-22) to 21.43 (E-2)
October 2007	15.19 (W-27) to 18.15 (E-2)
April 2008	20.17 (E-4) to 22.30 (W-27)
September 2008	11.25 (E-4) to 14.96 (W-27)
May 2009	17.38 (E-4) to 19.44 (W-27)
December 2009	12.26 (E-1) to 20.03 (E-4)

msl – mean sea level
Data Source: Table 2 of the 2009 Arcadis Groundwater Monitoring Report.

Groundwater Quality

Shallow Aquifer

Shallow wells are those screened within the approximate interval of 0 to 30 feet bgs (LFR, 1990). Constituents detected in the shallow aquifer since 2005 include 1,1-DCA, and 1,1,1-TCA. Table 6-3 shows the maximum concentrations of 1,1-DCE, 1,1-DCA, and 1,1,1-TCA detected in groundwater samples from the seven shallow wells (W-22, W-25, W-27, LF-2, E-3, E-5, and E-7) over the past five years. (LFR/Arcadis, 2009 and Roth, 2010). The concentrations of all three chemicals in most wells had shown a dramatic decline from high initial concentrations in 1986 to low concentrations or non-detect by 2005 and later. In well W-27, concentrations of 1,1-DCE, 1,1-DCA, and 1,1,1-TCA were non-detect in 1986 and rose later. Their concentrations fluctuated until April 1991, when 1,1-DCA started to steadily increase and remained above the MCL through 2009, except for an occasional dip in concentration. As of 2009, only one well (W-27) in the shallow aquifer is currently monitored for VOCs.

The concentration of 1,1-DCA in well W-27 currently exceeds the MCL of 5 µg/L, although it has been decreasing since 2005 and has dipped below the MCL. Since 2005, the 1,1-DCE concentration had been below the MCL (6 µg/L) in all locations (Figure 3).

Since 2005, 1,1,1-TCA has not been detected in groundwater samples collected from any of the shallow wells on the Site.

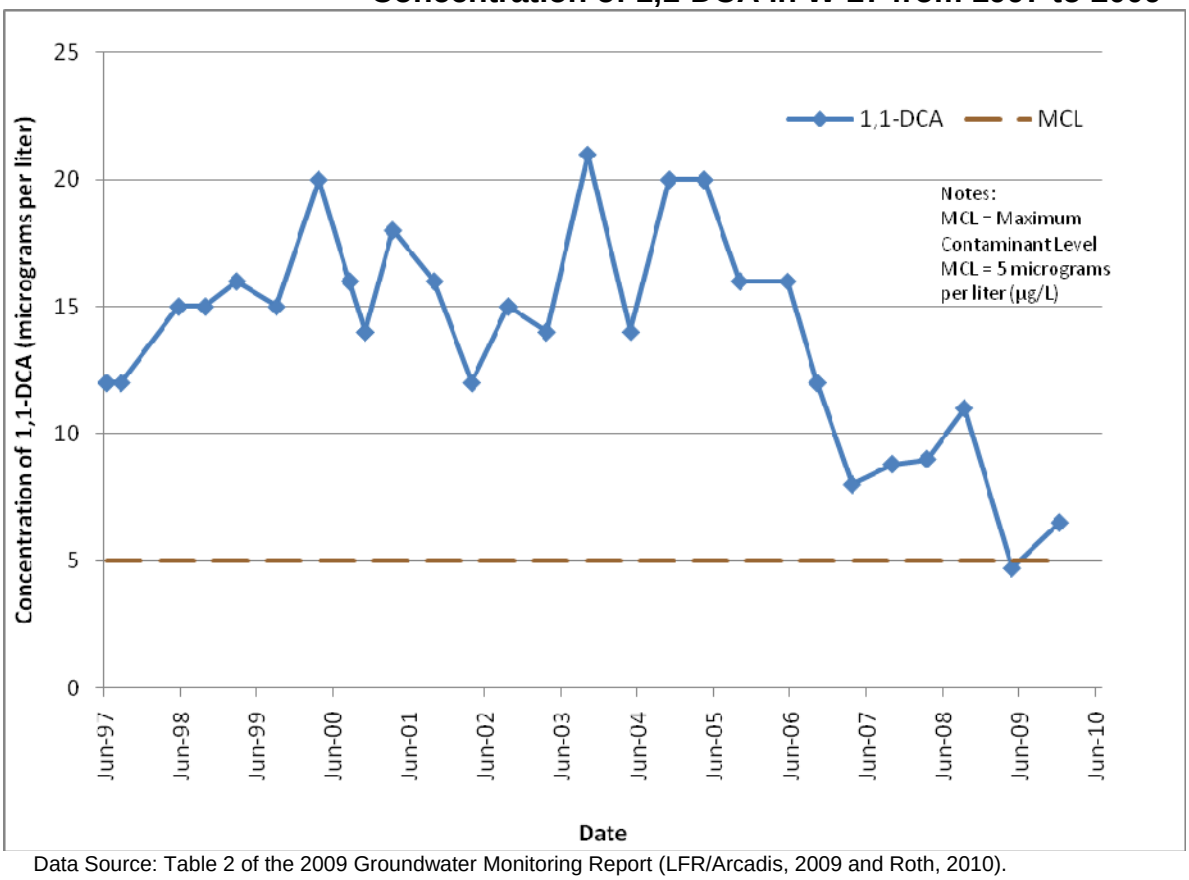
Groundwater was continuously analyzed and data reported for 1,2-DCA, TCE, and Freon 113, but most often these constituents were non-detect in all of the wells. Since 2005, 1,2-DCA, TCE, and Freon 113 have not been detected in any of the groundwater samples collected from shallow wells on the Site. No emerging constituents of concern (COCs) have been identified in soil or soil gas at the Site (EPA, 2005a).

Table 6-3
Shallow Aquifer Maximum Groundwater Concentrations of 1,1-DCE, 1,1-DCA, and 1,1,1-TCA Since October 2005
Sola Optical USA, Inc., Sonoma County, CA

Year	Maximum Contaminant Concentrations (Well Where Detected) (µg/L)		
	1,1-DCE	1,1-DCA	1,1,1-TCA
MCL	6 µg/L	5 µg/L	200 µg/L
2005	5.6 (E-5)	16 (W-27)	ND
2006	4.7 (E-5)	16 (W-27)	ND
2007	2.8 (E-5)	8.8 (W-27)	ND
2008	2.2 (W-27)	11 (W-27)	ND
2009	0.8 (W-27)	6.5 (W-27)	ND

µg/L – micrograms per liter
MCL – maximum contaminant level
ND – non-detect
Data Source: Table 2 of the 2009 Arcadis Groundwater Monitoring Report.

Figure 3
Concentration of 1,1-DCA in W-27 from 1997 to 2009



Data Source: Table 2 of the 2009 Groundwater Monitoring Report (LFR/Arcadis, 2009 and Roth, 2010).

Intermediate and Deep Aquifers

Intermediate wells were screened within an approximate interval of 30 to 60 feet bgs (LFR, 1990). All intermediate wells at the Site have been destroyed, and none were monitored during the Third Five-Year Review period. For information on groundwater quality of the intermediate aquifer at the Site, see the Second Five-Year Review report (EPA, 2005a).

Wells installed in three deeper zones referred to as the deep aquifer, deeper aquifer, and deepest aquifer have all been destroyed (LFR, 1990), and none were monitored during the Third Five-Year Review period. For more information on groundwater quality of these aquifers see the Second Five-Year Review report (EPA, 2005a).

6.5 Site Inspection

A Site inspection was performed on March 17, 2010. The inspection checklist is included as Appendix C and photographs from the inspection are presented in Appendix D. Representatives of Arcadis (formerly LFR) and Camp Dresser and McKee, Inc. (CDM) participated in a site inspection. The inspection included a Site walk and tour of the two parcels of land that make up the Site: (1) the actual facility property, and (2) the adjacent 11-acre lot, currently under development. Both parcels were originally owned by Sola, but have been sold to Kland, LLC and RNM, respectively.

The Site facility parcel has been owned by Kland, LLC since 2000. During the Site inspection, the original manufacturing building, an adjoining administration office building, and a parking lot surrounding the buildings were observed. Three commercial tenants currently occupy the Site building: Petaluma Poultry, Reynolds Packaging, and Scott Laboratories. The former USTs and groundwater extraction system were located behind the north corner of the facility. The facility property is only fenced along the southeast property boundary. The extraction wells remaining on the facility property (E-1, E-2, and E-4) were accessible and viewed during the inspection, as they are located within the paved parking lot. The extraction wells did not appear to be damaged and were secured. Mr. Roth (Arcadis) did not know of any vandalism that has occurred at the Site. There is no fence present between the main lot and the RNM lot, but there is a landscaped berm along a portion of this boundary.

The RNM lot is located southwest of the Site facility parcel. Since 2005, an asphalt parking lot and four building pads with the associated below grade infrastructure (i.e., electrical and plumbing) have been constructed on this lot. The groundwater monitoring well (W-27) located within the asphalt parking lot on the RNM lot had been converted from a standpipe well to a flush-mounted well. The well did not appear to be damaged and was secured. The northwest property boundary of the RNM lot (along Cader Lane) is fenced and the gate was locked. A sign with the name and phone number of the security company (Weinstein Security) is present on this gate. Signs indicating past construction activities at the RNM lot were also present.

The ICs selected for the Site include a restrictive covenant with the property owner to restrict groundwater uses that could result in unsafe exposure to people or the environment (EPA, 2007b). The second IC consists of restrictions within County of Sonoma's well permitting process. During the Site visit, no Site were observed that might indicate potentially unsafe exposures to people or the environment. For example, there were no new wells observed during the Site inspection and there was no ground disturbance observed on the Site.

6.6 Interviews

As part of the Third Five-Year-Review, interviews were conducted during the Site walk and over the phone with the following parties:

- Mr. Daren Roth, Project Geologist with Arcadis (the contractor for the potentially responsible party [PRP])
- Mr. Scott Seyfried, the Project Manager for the Sola Site from Arcadis
- Mr. Ken Tran, the Site building manager and part owner with Kland, LLC of the 1500 Cader Lane property (active building)
- Mr. Jamie Milliner, the Director of Project Management for RNM, who owns the 11 auxiliary acres located southwest of the 1500 Cader Lane property
- Mr. John Anderson, Senior Environmental Health Specialist III with the CSDHS–EHD (CSDHS–EHD reviews applications for the installation of groundwater monitoring wells)
- Mr. Bob Swift, the Supervising Environmental Health Specialist for the CSPRMD–Wells and Septic Division (Wells and Septic Division of the CSPRMD reviews permit applications for the installation of water supply and agricultural wells)
- Mr. John Jang, a caseworker with the Water Board

All parties concurred that no complaints or violations with respect to the Site had been received or observed and that the remedy appears to be progressing as planned. Mr. Swift indicated that the Permits Plus system, which is used to organize permit applications for the installation of water supply and agricultural wells in Sonoma County, does not contain any notice for the Site address that the Site parcel lies directly above the contaminated groundwater and wells should not be constructed on the property. Therefore, the IC portion of the remedy may not be operating as intended. Interview summary forms are presented as Appendix E.

Section 7
Technical Assessment

This section evaluates whether the remedy is functioning as intended, the current status of assumptions, and new information affecting the remedy.

Question A: Is the remedy functioning as intended by the decision document?

Remedial Action Performance

The MNA component of the remedy has almost met the 2007 ROD Amendment objective. The objective was to restore the groundwater to its beneficial uses by reducing the contamination levels to below State and Federal drinking water standards (MCLs). This reduction would result in eliminating the potential risk to human health from exposure to the groundwater. Although the 1,1-DCA concentrations detected at well W-27 remain above the MCL, the 1,1-DCA concentration trend is decreasing. This indicates that MNA is functioning as intended by the decision document.

Opportunities for Optimization

No opportunities for optimization were identified during this review.

Early Indicators of Potential Issues

There are no early indicators of additional potential issues.

Implementation of Institutional Controls

A review of ICs was conducted for this third five-year review and findings of the review were submitted in an IC Review Technical Memorandum (Appendix F). There are two ICs selected for the Site: a restrictive covenant and an IC involving the local well permitting process.

No restrictive covenant has been implemented, therefore this institutional control component of the remedy is not functioning as intended by the decision document. However, it is worth noting that, soon after transferring the property between them, Sola Optical and RNM entered into a "License and Environmental Restriction," recorded March 29, 2001, which restricts groundwater extraction. A copy of the license is provided in Appendix A. It prevents most uses of the groundwater, thereby limiting the risk of unacceptable exposure of humans or the environment, as long as RNM remains the property owner.

The IC involving the local well permitting process is not operating as intended. Applications for the installation of groundwater monitoring wells in Sonoma County follow a review process which includes the Water Board or the California Department of Toxic Substances Control (DTSC), who would notify the CSDHS–EHD reviewer that the application was for a Superfund site. However, applications for the installation of water supply and agricultural wells are reviewed by a different

division - CSPRMD–Wells and Septic Division. The CSPRMD–Wells and Septic Division relies on the Permits Plus system to organize permit applications for Sonoma County. When the Permits Plus system was recently searched by Mr. Swift of the CSPRMD, he noted that the file for the Site address does not contain any notice indicating that the Site parcel lies directly above the contaminated groundwater and that wells should not be constructed on the property. Although no additional wells have been installed on the Site since 2005, the County of Sonoma well permitting restriction IC has not been fully implemented, which impacts the future protectiveness of the remedy. Therefore, the IC portion of the remedy may not be operating as intended to prevent future exposure.

Question B: Are the exposure assumptions, toxicity data, clean-up levels, and RAOs used at the time of the remedy selection still valid?

Changes in Standards and To Be Considered (TBCs)

A review of applicable or relevant and appropriate requirements (ARARs) on the March 2007 ROD Amendment was conducted for this Third Fve-Year Review and findings of the review were submitted in an ARARs Review Technical Memorandum (Appendix G). The specific regulations cited for each were reviewed for changes. The current versions of the California Code of Regulations (CCR), Title 22 were reviewed to ensure all information is current.

The ARARs established in the 2007 ROD Amendment do not require revision to ensure the protectiveness of current remedial actions or to comply with new state or federal requirements. Groundwater clean-up goals for 1,1-DCA and 1,1-DCE based on federal and state criteria have not been updated from the values contained in the 2007 ROD Amendment. No ARARs were identified that are more stringent than the current clean-up levels for 1,1-DCA and 1,1-DCE.

Since shallow groundwater at the Site could in theory be used as a drinking water source, risk management for the Site included a remedy based on achieving drinking water standards. Groundwater cleanup standards established for the Site were California MCLs. For this Five-Year Review, the target and screening levels considered in the 2005 Five-Year Review for vapor intrusion were updated and reviewed to determine if the focus on MCLs as the Site groundwater cleanup standards remains appropriate. Table 7-1 shows Site groundwater contaminant concentrations and their respective MCLs, target groundwater concentrations and groundwater environmental screening levels (ESLs). The California MCLs presented in this table are the same as MCLs used in the 2005 Five-Year Review, except for Freon 113 (which could be a unit conversion error in the 2005 table). The Water Board updated ESLs in 2008 for vapor intrusion in 2008 (Water Board 2008). These updated values are presented in the table. These target and updated screening levels still exceed the groundwater MCLs. Therefore, the use of MCLs as the Site groundwater cleanup standards remains appropriate.

Table 7-1
Groundwater Concentrations, MCLs, Target Groundwater Concentrations, and Groundwater ESLs for Vapor Intrusion into Indoor Air
Sola Optical USA, Inc., Sonoma County, CA

Chemicals Detected in Groundwater at Sola Optical Superfund Site	Range of Site Concentrations Detected October 2005 to December 2009 (µg/L)	CDPH[a] Primary MCL (µg/L)	Target Groundwater Concentration (µg/L)[b]	Water Board Groundwater Screening Levels (µg/L)[c]
1,1,1-Trichloroethane	ND	200	3,100	130,000 – 360,000
1,1-Dichloroethylene	0.8 – 5.6	6	190	6,300 – 18,000
1,1-Dichloroethane	6.5 – 16	5	2,200	1,000 – 3,400
Methylene chloride	ND	5	5,800	2,400 – 8,100
1,2-Dichloroethane	ND	0.5	230	200 – 690
Trichloroethylene	ND	5	5.3	530 – 1,800
Freon 113	ND	1,200	1,500	NA

Notes:
a) CDPH = California Department of Public Health, Table updated April 14, 2010 (CDPH, 2010).
b) EPA Office of Solid Waste and Emergency Response (OSWER), 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). November 2002 (EPA OSWER, 2002). Target Groundwater Concentration to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor = 0.001 and Partitioning Across the Water Table Obeys Henry's Law C_{gw} for cancer risk = 10^{-4} and hazard index = 1.
c) California Regional Water Quality Control Board San Francisco Region, 2008. Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater – Interim Final. Table E-1. Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns. November 2007, updated May 2008 (Water Board, 2008). The range of concentrations shown represent residential to industrial exposure scenarios, high permeability soils assumed.

Changes in Exposure Pathways

A review of the 2007 ROD Amendment Human Health Risk Assessment (HHRA) was conducted for this third five-year review and findings of the review were submitted in an HHRA Review Technical Memorandum (Appendix H).

The assumptions made at the time of remedy selection concerning exposure pathways are generally unchanged. The risk assessment prepared in 1991 and discussed in the 1991 ROD evaluated the Site for hypothetical future residential for ingestion of contaminated groundwater and inhalation of contaminants in indoor air via vapor intrusion. However, the exposure assumption of residential use is more conservative than the current land use of industrial/commercial, so the exposure assumptions and subsequent clean-up standards remain protective of human health. The 1991 ROD risk assessment conducted for the Sola Site did not evaluate a homegrown produce pathway or an indoor air pathway for on-site workers and potential future residents. As part of the 2005 Five-Year Review, a screening-level review was conducted for these two pathways and concluded that the home-grown produce and indoor air pathways do not pose an increased health risk.

Changes in Toxicity and Other Contaminant Characteristics

Toxicity criteria for 1,1-DCE and 1,1-DCA were also reviewed for this Five-Year Review. EPA's online Integrated Risk Information System (EPA, 2010) indicates that these have not been revised since 2002 and 1990, respectively. The California EPA Office of Environmental Health Hazard Assessment (OEHHA) online toxicity database indicates that toxicity criteria for 1,1-DCA were last reviewed in 2009, however these values have not changed since 1992 (CalEPA, 1992; 2009). OEHHA does not list toxicity criteria for 1,1-DCE.

Changes in Risk Assessment Methods

Although EPA has not updated its vapor intrusion guidance document, the California DTSC issued its own vapor intrusion guidance (Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air) in 2004 and updated this guidance in February 2005. This document does not provide generic groundwater screening levels; it does, however, provide a conservative mathematical model (Johnson and Ettinger Excel spreadsheet model) for calculating cancer risks and non-cancer hazards from inhalation of vapors migrating from groundwater. These models have been adjusted by DTSC (GW-Screen Version 3.0 April 2003, last modified by DTSC on February 4, 2009) with California toxicity criteria and default parameters assuming a residential receptor. When the maximum Site groundwater concentrations of 1,1-DCE and 1,1-DCA detected from 2005 to 2010 are entered into the DTSC-adjusted Johnson and Ettinger model using default parameters and assuming a sand vadose zone, the cancer risk for 1,1-DCA is 9×10^{-7}, which is below the EPA risk management range of 10^{-6} to 10^{-4}. The hazard quotients for 1,1-DCE (0.04) and 1,1-DCA (0.002) are also well below the target threshold of one. The model printouts for these two chemicals are provided in Appendix H. Note that these calculations are not site-specific. Instead, they use conservative default input parameters to provide a screening level evaluation of the potential for vapor intrusion. The Johnson and Ettinger models were not used in the previous risk assessment or Five-Year Review.

Expected Progress Towards Meeting RAOs

The remedy of MNA and ICs has almost met the objective to restore the groundwater to its beneficial uses by reducing the contamination levels to below State and Federal drinking water standards (MCLs). The remedy is progressing as expected.

Question C: Has any other information come to light that could call into question the protectiveness of the remedy?

No new ecological receptors were noted during the Site inspection. No weather-related events have affected the protectiveness of the remedy. Exceedances of ROD constituents have been previously discussed in this review. There is no other information that calls into question the protectiveness of the remedy.

Section 8
Issues

Table 8-1
Summary Table of Issues
Sola Optical USA, Inc., Sonoma County, CA

Issues	Affects Current Protectiveness (Y/N)	Affects Future Protectiveness (Y/N)
1. Although no additional wells have been installed on the Site since 2005, the well permitting restriction IC is not properly in place, which impacts the protectiveness of the 2007 ROD Amendment remedy.	No	Yes
2. The restrictive covenant IC has not yet been implemented.	No	Yes

Section 9
Recommendations and Follow-up Actions

Table 9-1
Summary Table of Issues, Recommendations, and Follow-Up Actions
Sola Optical USA, Inc., Sonoma County, CA

Issue	Recommendations and Follow-up Actions	Party Responsible	Over-sight Agency	Milestone Date	Affects Protectiveness (Y/N)	
					Current	Future
The well permitting restriction IC is not properly in place.	a. The County of Sonoma needs to be contacted to ensure that the Permits Plus system is corrected so that the notice regarding Site well installation restriction comes up when a well permit application is entered into the system.	EPA	EPA	Autumn 2010	N	Y
The restrictive covenant IC has not been implemented.	b. Determine whether the restrictive covenant IC is required to protect human health in the short-term, and implement it, if so.	EPA	EPA	Spring 2012	N	Y

Section 10
Protectiveness Statement

The remedy at the Sola Site currently protects human health and the environment because the groundwater contamination has been reduced below drinking water standards (MCLs) in all but a very limited area around one well, no exposure pathways to the remaining contamination exist, and no one is using the groundwater resource. However, in order for the remedy to be protective in the long-term, the following actions need to be taken to ensure long-term protectiveness:

- The well permitting restriction IC within the CSPRMD Permits Plus system must be properly implemented to ensure the protectiveness of the remedy.
- Determine whether the restrictive covenant IC is required to protect human health in the short-term, and implement it if so.

Section 11
Next Review

The Sola Site will continue to have Five-Year Reviews in the future until the residual contamination in the groundwater at the Site achieves the clean-up standard. The next Five-Year Review will be conducted in 2015.

References

California Department of Toxic Substance Control (DTSC). 2005. *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air.* 2004, updated February 2005.

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Appendix A

Copy of Property Restriction

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PURCHASE AND SALE AGREEMENT

This PURCHASE AND SALE AGREEMENT (this "Agreement") is made as of September 15, 2000, by and between RNM CADER, L.L.C., a California limited liability company ("Buyer") and SOLA INTERNATIONAL, INC., a Delaware corporation ("Seller"). The above date is for reference purposes only. The "Effective Date" of this Agreement is as defined in Article 1.

RECITALS

A. Seller is the fee owner of that certain parcel of unimproved real property located in the City of Petaluma, Sonoma County, California as more particularly described in Exhibit "A" attached hereto (the "Property").

B. Buyer desires to purchase the Property from Seller and Seller desires to sell the Property to Buyer, all in accordance with the terms and conditions of this Agreement.

AGREEMENT

NOW, THEREFORE, in consideration of the mutual covenants set forth herein the parties hereto agree as follows:

1. **DEFINITIONS**. In addition to any other terms defined herein, the following terms, whenever used in this Agreement, shall have the meanings set forth below.

Additional Cash: The amount of the Purchase Price, (a) plus an amount sufficient to cover Buyer's share of Closing Costs as allocated herein, (b) less the Earnest Money Deposit placed into Escrow.

Broker: Meridian Commercial, Inc., agent for Seller.

Business Day: Any day excluding Saturday, Sunday and any day which is a legal holiday under the laws of the State of California or is a day on which banking institutions located in California are authorized or required by law or other governmental action to close.

Buyer's Address: c/o RNM Lakeville L.P.
135 Main Street, Suite 1140
San Francisco, CA 94105
Phone: (415) 904-1985
Fax: (415) 543-2917

With a copy to:
Law Offices of Mary Lu Everett
425 California St. Ste. 1800
San Francisco, CA 94104
Phone: (415) 394-5700
Fax: (415) 394-5003

Closing: The date on which the Deed is recorded in the Official Records of Sonoma County, California.

Closing Costs: All city and county documentary transfer stamps and taxes, all sales and excise taxes, the fees and costs of Escrow Agent, title insurance premiums and other charges of Title Company and all other title, escrow or recording fees payable in connection with the Closing.

Deed: A grant deed in the form of Exhibit "B" attached hereto.

Due Diligence Expiration Date: That day which is forty-five (45) days following the "Effective Date" as defined below.

Due Diligence Period: The 45-day period ending at 5:00 P.M. (Pacific Time) on the Due Diligence Expiration Date.

Due Diligence Review: (a) Such physical tests, inspections, environmental studies, surface and subsurface studies, surveys, and other investigations as Buyer elects (subject to Section 3.3 hereof) to determine, inter alia, the suitability of the Property for Buyer's intended use, the likelihood of Buyer's obtaining the necessary governmental approvals for Buyer's development of the Property, the economic merits of Buyer's proposed development of the Property, the status of the title to the Property, the environmental condition of the Property and other aspects which, in the opinion of Buyer, may affect Buyer's decision to purchase the Property ("Investigations"), and (b) a review of the Investigation Materials and any other documents or records relating to the condition of the Property and its proposed use.

Earnest Money Deposit: The principal sum of $[redacted], consisting of: (a) a first installment ("First Installment") in the amount of [redacted] due on the Effective Date; (b) an additional installment ("Second Installment") in the amount of [redacted] due when and if notice of approval of the result of Buyer's Due Diligence Review is delivered to Seller pursuant to Section 3.3 hereof on or before the Due Diligence Expiration Date; and (c) an additional installment ("Third Installment") in the amount of [redacted] due no later than one hundred and twenty (120) days after the Effective Date when and if Buyer has obtained site plan approval pursuant to Section 3.5 hereof and Buyer approves the Environmental Indemnification Agreement to be provided by Seller pursuant to Section 3.6 hereof. The Earnest Money Deposit also includes, in addition to the principal sum set forth above, any interest earned on the above Installments.

Effective Date: The day on which this Agreement has been executed and delivered by both parties hereto.

Escrow: As defined in Article 7 hereof.

Escrow Agent: North American Title Co., Inc., 2755 Mendocino Ave, Santa Rosa, California 95403. Attn: Leslie Hudson. Tel: (707) 545 5130; fax (707) 579 5462. Escrow number: 62225007.

Hazardous Materials: Oil and other petroleum products, flammable explosives, asbestos, urea formaldehyde insulation, radioactive materials, any substances which are "wastes", "hazardous substances," "hazardous wastes," "hazardous materials", "toxic substances", "pollutants" or "contaminants" under any past, present or future state or federal law, ordinance or regulation.

Hazardous Materials Laws: All statutes, ordinances, rules and regulations relating to Hazardous Materials, including without limitation those relating to the investigation and remediation of Hazardous Materials discharged or released to soil and groundwater.

Investigation Materials: As defined in Section 3.1 hereof.

Outside Closing Date: The one hundred and eightieth (180th) day after the Effective Date.

Owner's Policy: A standard California form ALTA or CLTA owner's policy of title insurance to be issued by Title Company in the amount of the Purchase Price, insuring Buyer's fee title to the Property subject only to the Permitted Exceptions.

Permitted Exceptions: All matters affecting title as of the date of Closing approved in writing by Buyer on or prior to the Due Diligence Expiration Date or as otherwise provided in Section 3.2 hereof.

Property. The real property described in Exhibit "A" attached hereto, including but not limited to (a) any improvements located thereon, and (b) all easements, rights-of-way permits, approvals, entitlements, development rights, water and sewer rights, building allotments and other rights appurtenant thereto.

Purchase Price: [redacted] per square foot. Seller's surveyor has computed the area of Property to be [redacted] square feet. Based on that computation, the Purchase Price is [redacted]. Seller shall provide Buyer with a certification of the square footage of the Property from Seller's surveyor during the Due Diligence Period. The principal amount of any outstanding and unpaid bonds and assessments plus any accrued and unpaid interest on such bonds or assessments which are liens against the Property shall be credited against the Purchase Price.

Seller's Address:

1500 Cader Lane
Petaluma, CA 94953
Attn: Mr. Richard Sanzari
Phone: (707) 763-9911, ext. 6470
Fax: (707) 763-2211

With a copy to:
Greene Radovsky Maloney & Share, LLP
Four Embarcadero Center Ste. 4000
San Francisco, CA 94111
Attn: Mark S. Hennigh
Phone: (415) 981-1400
Fax: (415) 777-4961

Title Company: North American Title Co., Inc. (Address same as Escrow Agent).

2. **PURCHASE AND SALE.**

2.1 Purchase and Sale. Seller agrees to sell the Property to Buyer and Buyer agrees to purchase the Property from Seller, subject the terms and conditions set forth herein.

2.2 Payment of the Purchase Price. The Purchase Price shall be payable as follows:

(a) On the Effective Date Buyer shall deposit the First Installment of the Earnest Money Deposit with the Escrow Agent. Subject to the provisions of Section 3.3 hereof, Buyer shall deposit the Second Installment of the Earnest Money Deposit with Escrow Agent no later than when notice of approval is delivered to Seller pursuant to said Section 3.3 on or before the Due Diligence Expiration Date. Buyer shall deposit the Third Installment of the Earnest Money Deposit with the Escrow Agent no later than one hundred and twenty (120) days after the Effective Date, subject to Buyer's right to terminate the Agreement and receive a return of the Earnest Money Deposit if Buyer has not obtained site plan approval from the City of Petaluma's Site Planning and Architectural Review Committee (SPARC) as provided in Section 3.5 hereof or Buyer and Seller have not agreed upon the form and substance of the Environmental Indemnity Agreement and the Additional Agreement as provided in Sections 3.6 and 3.7hereof. The parties shall direct Escrow Agent to deposit the Earnest Money Deposit into an interest bearing account. All payment(s) shall be in the form of cash, cashier's check or wire transfer of immediately available funds. All interest earned on the Earnest Money Deposit shall be added to and become part of the Earnest Money Deposit. Once Buyer has deposited the Second Installment with the Escrow Agent, the Earnest Money Deposit shall be non-refundable except as otherwise expressly provided in this Agreement and subject to Buyer's right to receive a full refund of such deposit upon a

termination of the Agreement by Buyer pursuant to Sections 3.5, 3.6 or 3.7.

(b) Prior to Closing, Buyer shall deposit the Additional Cash with Escrow Agent in the form of cash, cashier's check or wire transfer of immediately available funds.

3. **DELIVERIES; DUE DILIGENCE REVIEW; TERMINATION.**

3.1 Seller's Deliveries. Within five (5) Business Days following the Effective Date, Seller shall make available for review and copying by Buyer copies of all final consultant and other third party reports relating to the real property which is the subject of the EPA Order (as defined in Section 3.6), together with all other documents of which Seller is aware relating to: (a) real property encumbrances, easements, CC&R's etc; (b) taxes and assessments; (c) governmental notices; (d) drawings, plans and specifications; reports; surveys and (e) other material information relating to the Property. All documents shall be made available to Buyer and its representatives at Seller's Petaluma office during normal business hours upon 24 hours advance notice and Seller shall copy any and all such documents requested by Buyer. Seller, at its election, may require Buyer's written acknowledgment of receipt of documents copied and delivered by Seller to Buyer.

Reference to documents "of which Seller is aware" shall mean all documents of which Roman Starno, and/or Claire McCarthy (Director of Facilities and former Environmental Manager of Seller, respectively) are actually aware, all of which documents shall be made available to Buyer at the Petaluma office of Seller. Seller agrees to cooperate with and assist Buyer in obtaining any additional information which Buyer may reasonably request to assist it in its Due Diligence Review, provided that any out-of-pocket costs incurred by Seller to obtain the same shall be paid by Buyer.

3.2 Title Review. During the Due Diligence Period, Buyer shall have the opportunity to review and approve a preliminary title report for the Property (the "Title Report") to be prepared and provided by the Title Company on behalf of Buyer and, on or before the Due Diligence Expiration Date, Buyer shall notify Seller of any objection(s) that Buyer may have concerning the status of title to the Property ("Buyer's Objections"). Any exceptions to title not expressly disapproved by Buyer in writing on or before the Due Diligence Expiration Date shall be deemed approved by Buyer without any further action on its part whatsoever (the "Approved Exceptions"). In the event that Buyer requires an ALTA policy of title insurance, the ALTA survey shall be prepared by Buyer, at Buyer's sole cost and expense, and all survey exceptions reviewed by Buyer during the Due Diligence Period. Seller shall attempt to satisfy the Buyer's Objections (if any) prior to the Closing, but shall not be required to institute any litigation or incur any cost to do so. If, prior to the Closing, Seller notifies Buyer in writing that Seller will not satisfy any of Buyer's Objections, then, within seven

(7) days of such written notice from Seller (and, if necessary, the Closing shall be extended by the number of days necessary to give Buyer this full 7-day period), Buyer shall notify Seller in writing that Buyer either: (i) waives those title objections which cannot be satisfied and accepts title subject to such exceptions; or (ii) terminates this Agreement in accordance with Article 9 hereof. If, prior to the Closing, Seller notifies Buyer in writing that Seller will satisfy all of Buyer's Objections, Seller shall satisfy the same prior to and as a condition to Buyer's obligation to close Escrow. The Approved Exceptions and any other exceptions which Buyer approves in writing shall be referred to herein as "Permitted Exceptions."

3.3 Due Diligence Review. Commencing on the Effective Date and ending at 5:00 P.M. (Pacific Time, as then in effect) on the Due Diligence Expiration Date, Buyer shall have the right, at its sole cost and expense, to conduct a Due Diligence Review, including an on-site inspection and testing of the Property. As a condition to Closing, Buyer shall deliver to Seller its written approval of its Due Diligence Review on or before the Due Diligence Expiration Date. If Buyer fails to provide such notice of approval, then this Agreement shall terminate automatically and without further action on the part of either party, and the parties shall direct the Escrow Agent to deliver to Buyer the Earnest Money Deposit.

3.4 Investigations. The Investigations shall be conducted only in accordance with the following procedures:

(a) Buyer shall exercise due care in entering upon, inspecting and testing the Property, and shall perform all such entry, inspection and testing in a professional manner so as to minimize damage or disruption of the Property.

(b) Buyer agrees to pay promptly all costs associated with the Investigations and not to permit any lien or encumbrance to be asserted against the Property in connection with any Investigations. Within twenty (20) days after receipt of notice from Seller, Buyer shall (a) pay and remove or (b) "bond off" any mechanic's liens relating to the Investigations. Buyer shall obtain, at Buyer's sole cost and expense, any licenses or permits required by Federal, state or local law in order to perform any inspections or tests on/of the Property.

(c) Buyer shall, at its own expense, promptly fill and compact any holes, and otherwise restore any damage to the Property, caused by the conduct of any Investigations. Buyer and Buyer's representatives shall immediately thereafter vacate the Property.

(d) If Buyer intends to perform any invasive testing at the Property or inspect the Property for the presence of any toxic materials, Buyer

shall provide Seller with at least five (5) days' prior written notice detailing the extent and scope of such testing or inspection and obtain Seller's prior approval. Seller shall not unreasonably withhold or delay its approval of such testing and inspection. If any contamination is found as a result of such testing or inspection, Buyer shall immediately provide Seller with all information and copies of all reports relating to such testing or inspection, and Buyer covenants and agrees not to contact or inform any public or quasi-public agency concerning such contamination without first obtaining the prior written consent of Seller, which Seller may withhold in its sole and absolute discretion; provided, however, that Buyer may inform an applicable public or quasi-public agency concerning such contamination without the prior written consent of Seller if Buyer is affirmatively required to inform that public or quasi-public agency pursuant to applicable law.

(e) All inspections of the Property requiring access to the Property will be conducted only following at least 24-hours' advance notice to Seller and, at the request of Seller, with a representative of Seller present.

(f) Buyer shall defend, indemnify and hold harmless Seller, SOLA Optical USA, Inc., and SOLA Holdings, Inc. (collectively the "SOLA Parties") from and against any and all claims, damages, losses, costs, expenses and liabilities (including but not limited to all attorneys' fees and court costs paid or incurred by the SOLA Parties) which arise out of or are in any way connected with Buyer's entry upon or inspection or testing of the Property (other than the Property's loss of value or marketability due to Buyer's discovery of defects). Buyer shall obtain and maintain commercial general liability insurance in the amount of [redacted] naming the SOLA parties as additional insureds and shall provide Seller with evidence thereof prior to conducting its on-site Investigations.

3.5 SPARC Approvals. Buyer shall apply for site plan approval from the City of Petaluma's Site Planning and Architectural Review Committee (SPARC) for Buyer's intended development of the Property promptly after its execution and delivery of this Agreement and shall pursue such approval process with all due diligence. If Buyer has not received SPARC approval of Buyer's site plan for the proposed development of the Property within one hundred and twenty (120) days after the execution and delivery of this Agreement into Escrow, Buyer shall have the right, at Buyer's sole discretion, to either (i) waive this contingency and deposit the Third Installment, or (ii) terminate this Purchase Agreement by written notice to Seller, in which event the Earnest Money Deposit shall be returned to Buyer by the Escrow Agent and all obligations of the parties to each other shall terminate.

3.6 Environmental Indemnification. Seller has disclosed to Buyer the presence of Hazardous Materials in subsurface soils on the Property and the parcel of real property owned by Seller adjacent to the property (the "Adjacent Parcel") and in ground water associated with the Property and the Adjacent Parcel (the "Existing Environmental Conditions") and the existence of ground water monitoring wells which Seller was required to install to monitor such ground water environmental conditions. In June, 1988, the Property and the Adjacent Property were proposed for listing on the National Priorities List ("NPL") maintained by the U.S. Environmental Protection Agency (the "EPA") pursuant to the Comprehensive Environmental Response Compensation and Liability Act. The Property and the Adjacent Property were added to the NPL in February, 1990. Seller is currently required to furnish periodic reports to the EPA pursuant to EPA Order #92-07 (the "EPA Order"). The remedy, operation and maintenance of the remedy and ground water monitoring and reporting required by the EPA Order are collectively referred to herein as the "Remedial Work". As a condition to closing, Seller shall provide to Buyer an "Environmental Indemnity Agreement" executed by the SOLA Parties in form and substance satisfactory to Buyer in Buyer's sole discretion. If Buyer and Seller fail to agree on the form for the Environmental Indemnity Agreement within 120 days after the Effective Date, either party shall have the right to terminate this Agreement by notice to the other party given prior to the date such an agreement is reached and the Earnest Money Deposit shall be returned to Buyer upon such termination and the parties shall have no further obligations hereunder.

3.7 Additional Agreement. Due to the Existing Environmental Conditions, the parties desire to prevent those activities on the Property and the Adjacent Parcel which would exacerbate the Existing Environmental Conditions, and to provide Seller with the access to the Property required for Seller's performance of Seller's Remedial Work. At Closing the parties shall enter into an agreement (the "Additional Agreement") with respect to such matters. Within ten (10) days after the Effective Date, Seller shall deliver to Buyer a draft of the Environmental Indemnity Agreement and the Additional Agreement. Seller and Buyer shall diligently and in good faith negotiate the terms of the two (2) agreements. If Buyer and Seller fail to agree on the form and terms of the Environmental Indemnity Agreement and the Additional Agreement within one hundred twenty (120) days after the Effective Date, either party may terminate this Agreement by notice to the other party and the Earnest Money Deposit shall be returned to Buyer and the parties shall have no further obligations hereunder, except for any indemnity obligations which survive the termination. The Additional Agreement shall address (a) removal/disturbance of ground water other than as required for Buyer's construction of improvements on the Property and (b) access rights for performance of Remedial Work.

3.8 Buyer's Acknowledgment. Buyer acknowledges that, subject to the representations and warranties of Seller set forth in Section 6.1 hereof and except for matters involving the environmental condition of the Property which matters will be covered in the Environmental Indemnity Agreement between the parties,

Buyer has entered into this Agreement with the intention of making and upon Buyer's removing the inspection contingency pursuant to Section 4.1(a), relying upon, such investigations of the Property as Buyer has deemed necessary and appropriate. Subject to the foregoing, Buyer acknowledges, for itself and for its successors, heirs and assigns, that Buyer:

(a) Is a sophisticated investor, knowledgeable and experienced in the financial and business risks attendant to an investment in income property and capable of evaluating the merits and risks of entering into this Agreement and purchasing the Property;

(b) Has entered into this Agreement with the intention of making and relying upon its own (or its experts') investigations of the physical, (excluding environmental), economic and legal condition of the Property, including without limitation all documents and entitlements relating to the Property, the compliance of the Property with laws and governmental regulations and the operation and proposed use of the Property;

(c) Is not relying upon any representations and warranties, other than those specifically set forth in this Agreement and the Environmental Indemnity Agreement, made by Seller or anyone acting or claiming to act on Seller's behalf concerning the Property or:

(i) the suitability of the Property for any activities or use;

(ii) habitability, profitability or fitness for a particular purpose; or

(iii) any other matter not expressly addressed herein.

(d) Has been given a reasonable opportunity to inspect and investigate the Property, either independently or through agents or experts of Buyer's choosing.

Buyer further acknowledges that it has not received from Seller any accounting, tax, legal, architectural, engineering, property management or other advice with respect to this transaction and is relying upon the advice of its own accounting, tax, legal, architectural, engineering, property management and other advisors

4. **CONDITIONS PRECEDENT**.

4.1 Conditions to Buyer's Performance. Buyer's obligation to purchase the Property shall be subject to and contingent upon the satisfaction or written waiver by Buyer of each and every one of the following conditions precedent:

(a) Buyer's inspection and approval on or before the Due Diligence Expiration Date of all title matters relating to the Property and of all other physical, environmental, legal, economic and other

matters relating to the Property, as Buyer may, in its sole discretion, elect to investigate and (subject, however, to the provisions of Section 3.4 hereof);

(b) Buyer's receipt of the SPARCS approval and Seller's delivery into escrow of an Environmental Agreement in form and substance acceptable to Buyer, duly executed by Seller; and

(c) The willingness of the Title Company to issue, upon the sole condition of the payment of its regularly scheduled premium, an owner's policy of title insurance, in the form and with such endorsements as the Buyer may reasonably require (collectively, the "Owner's Policy"), insuring the Buyer in the amount of the Purchase Price that fee simple title to the Property is vested of record in the Buyer on the Closing Date, subject only to the standard printed conditions and exceptions of the Title Policy and the Permitted Exceptions.

(d) Seller's recordation of the deed required to effect the Lot Line Adjustment described in Section 5.2 hereof.

(d) The truth and correctness of each of Seller's representations and warranties as set forth in Section 6.1 hereof.

(e) The satisfaction or written waiver of Seller's performance of each and every covenant required to be performed by the Seller hereunder.

(f) Seller's due execution and acknowledgement of the Additional Agreement in form and substance acceptable to Buyer.

(g) Seller's removal of the designated monitoring wells and existing structures and equipment on the Property as provided in Sections 5.3 and 5.4.

4.2 Conditions to Seller's Performance. The obligations of Seller to convey to Buyer its interests in the Property shall be subject to and contingent upon:

(a) The satisfaction or written waiver of Buyer's performance of each and every covenant required to be performed by the Buyer hereunder.

(b) The truth and correctness of each of Buyer's representations and warranties as set forth in Section 6.3 hereof, and

(c) Buyer's due execution and acknowledgement of the Additional Agreement in form and substance acceptable to Seller.

4.3 Waiver or Failure of Conditions Precedent. At any time or times on or before the date specified for the satisfaction of the respective condition, Buyer or Seller may elect to waive in writing the benefits of any of their respective conditions set forth in Sections 4.1 or 4.2 hereof, as applicable. In the event that any of the conditions set forth in Sections 4.1 or 4.2 hereof are neither waived nor fulfilled, Buyer or Seller (as appropriate) may terminate this Agreement in accordance with the provisions of Article 9 hereof.

5. SELLER'S COVENANTS.

5.1 Condition of Property. Through the Closing or termination of this Agreement, Seller shall maintain the Property in its current condition and shall not enter into any contracts affecting the use, possession or condition of the Property.

5.2 Lot Line Adjustment. The Property consists of one parcel of approximately 15.19 acres and a portion (approximately 6.08 acres) of the Adjacent Parcel. During the Due Diligence Period, and as a condition to Closing, Seller shall obtain all required approvals for a lot line adjustment and effect such lot line adjustment so that, at the Closing, the Property will consist of only one legal parcel of approximately 21.27 acres. Seller agrees to apply for the lot line adjustment promptly after the date of this Agreement and to pursue the approvals for such adjustment with due diligence. If this condition is not met, Buyer may terminate this Agreement upon notice to Seller and the Earnest Money Deposit shall be returned to Buyer by Escrow Agent.

5.3 Monitoring, Removing and Relocating Wells. There are currently a number of monitoring wells located on the Property, some of which are in locations which may interfere with Buyer's proposed development for the Property. As a condition to Buyer's obligation to close, subject to Seller's obtaining all approvals required from the EPA and all other required approvals and permits (collectively, "Approvals"), Seller shall remove or relocate those monitoring wells designated by Buyer which conflict with the site plan for Buyer's proposed development of the property submitted to SPARC as provided in Section 3.5 hereof. Prior to the expiration of the Due Diligence Period, Buyer may designate to Seller the location of the monitoring wells to be removed or relocated to a location acceptable to Buyer. Promptly after receipt of Buyer's designation, Seller shall apply for and pursue with due diligence all Approvals. If conditions to Approvals would require Seller to replace or relocate any of the designated wells, Seller shall comply with such conditions at its sole cost and expense. If the conditions to approval would require Seller to incur material costs in excess of the costs to replace or relocate the designated wells ("Excess Costs"), Seller shall notify Buyer of the anticipated Excess Costs in which event Buyer at its election can either instruct Seller to

proceed with the approvals and pay all Excess Costs, (ii) terminate this Agreement and have the Earnest Money Deposit returned or (iii) waive the relocation or removal of those wells which will result in the Excess Costs and proceed to Closing. If Seller is unable to obtain the required Approvals within one hundred twenty (120) days after the execution and delivery of this Agreement by both parties, the approval period (and the Outside Closing Date) shall be extended by Buyer for the period of time reasonably required for Seller to obtain the same, provided that in no event shall the Outside Closing Date be extended beyond March 30, 2001 pursuant to this Section 5.3. If Seller's application is denied or the Approvals are not obtained within such period (as may be extended), Buyer may elect, by written notice to Seller given within ten (10) days after the period in which to obtain the Approvals has elapsed, to either waive this condition or terminate this Agreement. If Buyer fails to so elect, this Agreement shall be deemed to be terminated. In the event of a termination of this Agreement pursuant to this Section 5.3, the Earnest Money Deposit shall be refunded to Buyer and the parties shall thereafter be released from all further obligations hereunder.

5.4 Existing Structures. Prior to Closing, Seller will remove all existing structures and equipment from the Property (other than monitoring wells which are not designated to be removed or relocated pursuant to Section 5.3 above) and repair any damage caused by such removal.

6. REPRESENTATIONS AND WARRANTIES.

6.1 Seller's Representations. Seller hereby makes the following representations and warranties to Buyer, which shall be effective and enforceable both as of the date of this Agreement and as of the close of escrow.

(a) To the best of Seller's knowledge, the documents and materials made available to Buyer at Seller's Petaluma office pursuant to Section 3.1 above, include all of the documents with respect to the Property which are in Seller's possession or control.

(b) Except as has been provided to Buyer in the Investigation Materials, there are no leases, options, rights of first refusal, rights of redemption or other commitments relating to the Property, nor are there or any service or maintenance contracts which pertain to the Property that cannot be terminated on thirty (30) days' prior notice.

(c) Seller has all requisite legal power and authority to enter into and perform this Agreement and the persons executing this Agreement on behalf of Seller are duly authorized to execute and deliver this

Agreement on behalf of Seller and to perform Seller's obligations under this Agreement.

(d) To the best of Seller's knowledge, there is no litigation, administrative proceeding or any other claim pending or threatened against or affecting the Property (including rezoning or eminent domain proceedings), and Seller has no actual knowledge of any basis upon which a person could initiate, assert or threaten any such litigation, proceeding or other claim.

(e) To the best of Seller's knowledge, Seller has not received any notice of any violation of any zoning, environmental or building codes relating to the Property other than as has been disclosed to Buyer in the Investigation Materials.

For purposes of this Agreement, the phrase "to the best of Seller's knowledge" means to the actual knowledge of Roman Starno and Claire McCarthy.

6.2 Seller's Disclaimers. Except as expressly set forth in this Agreement and in the Environmental Indemnity Agreement, Seller makes no representation or warranty, express or implied, written or oral, concerning the Property or any use to which the Property may or may not be put, including, but not limited to the following:

(i) The condition of title to the Property;

(ii) The nature, physical condition or other aspects of the Property;

(iii) The expenses paid or incurred in connection with the Property;

(iv) The suitability or fitness of the Property for any intended use or development;

(v) The dimensions of the Property or the accuracy of any square footage, sketches or revenue or expense projections related to the Property;

(vi) The merchantability, marketability or habitability of the property; and

(vii) The compliance of the Property with any laws, rules, ordinances or regulations.

(viii) The accuracy of any reports prepared by Seller's third party consultants.

6.3 Buyer's Representations. Buyer hereby makes the following representations to Seller, which shall be effective and enforceable both as of the date of this Agreement and as of the close of escrow: Buyer has all requisite power and authority to enter into and perform this Agreement, and the persons executing this Agreement on behalf of Buyer are duly authorized to execute and deliver this Agreement on behalf of Buyer and to perform Buyer's obligations under this Agreement.

6.4 Survival. The representations and warranties of the parties made herein shall survive the Closing.

7. **ESCROW AND CLOSING.**

7.1 Escrow Instructions. Promptly following execution of this Agreement by Buyer and Seller, Buyer and Seller shall prepare and deliver to Escrow Agent written escrow instructions consistent with the terms of this Agreement and reasonably satisfactory to both Buyer and Seller. Such escrow instructions shall incorporate the relevant provisions of this Agreement by reference and shall provide that in the event of any conflict between such incorporated provisions of this Agreement and such escrow instructions, such incorporated provisions of this Agreement shall prevail and control. This sale shall be consummated through the escrow ("Escrow") so established with Escrow Agent.

7.2 Deposits Into Escrow. Not later than the date required by Escrow Agent for a timely Closing, the parties shall provide Escrow Agent with such information, documents, instruments and funds as Escrow Agent may reasonably require to effect the Closing, including but not limited to the following:

(a) Buyer shall deposit the Additional Cash and such other amounts as Buyer has agreed to pay under this Agreement.

(b) Seller shall deposit a fully completed, executed and dated Deed, in recordable form, a duly executed Environmental Indemnity Agreement approved by Buyer as provided in Section 3.6 above and the duly executed Additional Agreement in recordable form approved by Buyer as provided in Section 3.7 above and, and an affidavit executed by Seller to the effect that Seller is not a "foreign person" within the meaning of IRS Code 1445 or successor statutes, and the equivalent California form.

7.3 Further Assurances. Buyer and Seller agree to execute all instruments and documents and to take all actions reasonably necessary and appropriate to consummate the purchase and sale of the Property and shall use their best efforts to accomplish the Closing in a timely manner.

7.4 The Closing.

(a) Except as expressly provided elsewhere herein, the Closing shall take place on or before the Outside Closing Date. Escrow Agent shall close the Escrow by (i) causing the recording of the Deed and the Additional Agreement (in that order of priority) in the Official Records of Sonoma County, California, (ii) delivering to Seller all funds deposited into Escrow by Buyer in payment of the Purchase Price after prorations and deduction of any items chargeable to Seller's account, (iii) causing Title Company to issue the Owner's Policy to Buyer, WHEN AND ONLY WHEN all funds and documents described in Section 7.2 hereof have been delivered to Escrow Agent, and (iv) delivering to Buyer the Environmental Indemnity Agreement executed by Seller.

(b) Escrow Agent shall prorate the following between the parties as of the Closing:

(i) All county, city and special district taxes on the Property shall be prorated. Escrow Agent shall base the proration on the most current information available to Escrow Agent. To the extent any refunds, rebates or other payments resulting from or connected with tax appeals for the current tax year which are pending as of the Closing become payable prior to or after the Closing, such refunds, rebates or other payments shall be prorated as of the Closing, after reimbursement is made to Seller for all costs and expenses, including but not limited to attorneys' fees and witness fees, incurred by Seller in connection with the commencement and prosecution of such appeals.

(ii) All prepaid and all accrued but unpaid water, electric power, gas, lighting and other utility costs, all prepaid and accrued but unpaid charges under all contracts and such other prepaid and accrued but unpaid expenses incurred by Seller in connection with the operation of the Property as are customarily prorated shall be prorated by Escrow Agent.

(c) Seller shall pay all documentary and other state or local transfer taxes payable in connection with the purchase and sale of the Property. Buyer shall pay all other Closing Costs including all premiums for the Owner's Policy, recording fees and all escrow fees. All other costs shall be allocated between the parties in accordance with customary practice in the County of Sonoma, California.

(d) Seller shall pay the Broker pursuant to the Exclusive Sales Agreement between Seller and Broker. Each party to this Agreement warrants to the other that it has not incurred and will not incur any obligation, by reason of this Agreement or the transaction contemplated hereby, for any other real estate brokerage commission or finder's fee for which the other party would be liable. Each party shall, and hereby agrees to, defend, indemnify and hold the other party harmless from and against any and all liabilities, damages and costs that the other party may incur by reason of the untruth, as to the warranting party, of the warranty set forth in the preceding sentence of this Section, including, but not limited to, expenses for attorneys' fees and court costs.

(e) Buyer shall pay all premiums for the ALTA Owner's Policy of title insurance. The Owner's Policy shall name Buyer as the insured, shall insure Buyer's title to the fee estate in the Property, shall be in the amount of the Purchase Price and shall be delivered to Buyer at Closing.

(f) Possession of the Property shall be delivered to Buyer at Closing.

8. **CONDEMNATION AND CASUALTY.**

8.1 Condemnation. If prior to the Closing a taking or condemnation of any portion of the Property has occurred, or is threatened, either Buyer or Seller may, at its option, terminate this Agreement in accordance with Article 9 hereof within thirty (30) days after notice of such event. If the aggregate area taken is less than 1% of the total square footage of the Property and is taken from the perimeter and has no material effect on Buyer's proposed development of the Property, however, then neither party shall have the right to terminate. If neither party provides said termination notice within such 30-day period, the Close of Escrow shall take place as set forth in this Agreement, provided that: (i) Buyer shall receive a credit against the Purchase Price in an amount equal to the condemnation award actually collected by the Seller prior to the Close of Escrow; and (ii) Seller shall assign to Buyer at the Close of Escrow all of the Seller's interest in and to any condemnation award which may be due but unpaid to the Seller on account of any such occurrence.

8.2 Casualty. If prior to the Close of Escrow the Property shall sustain damage in excess of One Hundred Thousand and No/100 U.S. Dollars (U.S. $100,000.00) caused by fire, earthquake, landslide or other casualty, Buyer may, at its option, terminate this Agreement in accordance with Article 9 hereof within thirty (30) days after notice of such event. Because all existing structures and equipment are to be removed prior top the Close of Escrow pursuant to Section 5.4, damage to any improvements being removed shall not be considered for the purposes of this Section 8.2. If

Buyer does not provide such termination notice within such 30-day period, the Close of Escrow shall take place as set forth in this Agreement, provided that: (i) Buyer shall receive a credit against the Purchase Price in an amount equal to the insurance proceeds actually collected by Seller prior to the Close of Escrow; and (ii) Seller shall assign to Buyer at the Close of Escrow all of Seller's interest in and to any insurance proceeds which may be due but unpaid to that Seller on account of any such occurrence.

9. **TERMINATION**. In the event that either Buyer or Seller desires to exercise any express right to terminate this Agreement, such party shall give written notice of termination and the reason therefor to the other parties. Thereafter, except in the event of a termination based upon a default by either party in the performance of its obligations under this Agreement, and effective as of the effective date of such notice, each party shall be released from its obligations hereunder and all monies and documents deposited into Escrow shall be returned to the party which deposited them, all documents delivered by Seller to Buyer relating to the Property shall be returned to Seller and, to the extent not previously delivered to Seller, a copy of all reports, studies, analyses and tests prepared by or for Buyer relating to the Property shall promptly be delivered to Seller; provided, however, that (i) Seller shall not distribute such reports to any third party (other than to Seller's consultants in connection with this transaction); (ii) nothing herein shall limit Buyer's indemnity set forth in Section 3.4 hereof, and (iii) Buyer's delivery shall be without representation or warranty with respect to the preparation or content of such documents and shall be subject to the rights of the consultants preparing the same.

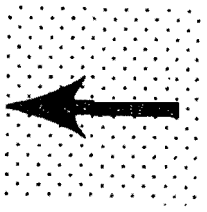
10. **DEFAULT**.

10.1 LIQUIDATED DAMAGES. IN THE EVENT OF DEFAULT BY BUYER IN THE PERFORMANCE OF ITS OBLIGATION TO CLOSE HEREUNDER AND SELLER IS NOT OTHERWISE IN MATERIAL DEFAULT HEREUNDER, SELLER SHALL HAVE THE RIGHT TO TERMINATE THIS AGREEMENT FORTHWITH AND, OTHER THAN FOR THE INDEMNITY OBLIGATIONS OF BUYER SET FORTH IN SECTION 3.4 HEREOF, NEITHER SELLER, ON THE ONE HAND, NOR BUYER, ON THE OTHER HAND, SHALL HAVE ANY FURTHER OBLIGATION TO THE OTHER EXCEPT FOR SELLER'S RIGHT TO AN IMMEDIATE DISBURSEMENT AND RETENTION OF THE EARNEST MONEY DEPOSIT AS LIQUIDATED DAMAGES AS ITS SOLE REMEDY IN LIEU OF ANY OTHER RIGHT TO DAMAGES OR RIGHT TO SPECIFIC PERFORMANCE OF THIS PURCHASE AGREEMENT AND SELLER WAIVES ANY FURTHER RIGHT TO CLAIM DAMAGES FROM BUYER OR SEEK OTHER LEGAL OR EQUITABLE REMEDIES AS A RESULT OF FAILURE BY BUYER TO COMPLETE THE PURCHASE.

BUYER AND SELLER AGREE THAT, BASED UPON THE CIRCUMSTANCES NOW EXISTING, THE FOREGOING AMOUNT IS REASONABLE AS LIQUIDATED DAMAGES. RETENTION OF SUCH AMOUNT BY SHALL CONSTITUTE LIQUIDATED DAMAGES PURSUANT TO CALIFORNIA CIVIL CODE SECTIONS 1671, 1676 AND 1677. THE PARTIES ACKNOWLEDGE THAT THE ACTUAL DAMAGES WHICH WOULD RESULT TO SELLER AS A RESULT OF SUCH FAILURE WOULD BE EXTREMELY DIFFICULT TO ESTABLISH. IN ADDITION, BUYER DESIRES TO HAVE A LIMITATION PUT UPON ITS POTENTIAL LIABILITY TO SELLER IN THE EVENT THAT THIS TRANSACTION SHALL FAIL TO CLOSE. BY PLACING THEIR RESPECTIVE INITIALS IN THE SPACES HEREINAFTER PROVIDED, THE PARTIES ACKNOWLEDGE THAT UPON A DEFAULT BY BUYER UNDER THE TERMS OF THIS AGREEMENT, SELLER SHALL BE ENTITLED TO LIQUIDATED DAMAGES IN THE AMOUNT OF THE EARNEST MONEY DEPOSIT, WHICH SHALL BE THE FULL, AGREED-UPON AND LIQUIDATED DAMAGES FOR THE BREACH OF THIS AGREEMENT BY BUYER.

PLEASE INITIAL: _____ _____

SELLER BUYER



10.2 Default by Seller. In the event of a default by Seller under this Agreement, Buyer shall have the right to pursue any remedy available to Buyer at law or in equity, including without limitation the specific performance of this Agreement by Seller, except that Seller shall not be liable for consequential damages or loss of profits..

11. **NOTICES**. Any notice or other communication required or permitted under this Agreement shall be in writing, and shall be (a) personally delivered, or sent via major air courier service that provides a receipt for delivery or attempted delivery, to the address of the party set forth in Article 1 of this Agreement or (b) telecopied to the fax number of the party set forth in Article 1 of this Agreement. Such notice or communication shall be deemed given when delivered to the office of the party to whom the notice was sent or on the next business day if delivered on a weekend or holiday. Notice of change of address shall be given by written notice in the manner detailed in this Article 11.

12. **GENERAL PROVISIONS**.

12.1 Successors and Assigns. This Agreement shall be binding upon and inure to the benefit of the successors and assigns of the parties. Buyer intends to assign all of its interest in this Agreement to a corporation or other entity

under common control as Buyer which will assume all of the Buyer's obligations under this Agreement. Seller agrees to recognize and permit the assignment provided the assignee assumes all of the Buyer's obligations under this Agreement and Buyer shall not be released from any liability hereunder until the Closing.

12.2 Entire Agreement; Amendments.. This Agreement contains the entire agreement between the parties concerning the purchase and sale of the Property, and no addition to or modification of any term or provision shall be effective unless in writing, signed by both Buyer and Seller.

12.3 Time of Essence. Buyer and Seller hereby acknowledge and agree that time is strictly of the essence with respect to each term and condition of this Agreement and that the failure to timely perform any of the terms and conditions by either party shall constitute a breach and default under this Agreement by the party failing to perform.

12.4 Partial Invalidity. If any portion of this Agreement shall be declared by any court of competent jurisdiction to be invalid, illegal or unenforceable, that portion shall be deemed severed from this Agreement and the remaining parts shall remain in full force as fully as though the invalid, illegal or unenforceable portion had never been part of this Agreement.

12.5 Governing Law. The parties intend and agree that this Agreement shall be governed by and construed in accordance with the laws of the State of California.

12.6 Jurisdiction. Each party hereto hereby submits to the exclusive jurisdiction and venue of the Superior Court of the State of California for the City and County of San Francisco, or the Federal District Court for the Northern District of California sitting in San Francisco, California for the purposes of any legal action arising in connection with this Agreement, the breach thereof or the transactions contemplated herein, and agrees that service upon such party in any such action may be made by first class mail, certified or registered, to the address set forth above.

12.7 Attorneys' Fees and Costs. If any action (whether legal or equitable and whether litigation or arbitration or some other proceeding), including any action for declaratory relief, enforcement, collection or an appeal, is brought under this Agreement, the prevailing party (as shall be determined by the court or other adjudicator) shall be entitled to recover its reasonable attorneys' fees and costs of suit from the other party in addition to such other relief as may be granted. Each party to this Agreement was represented by an attorney in the negotiation and execution of this Agreement.

12.8 Expenses. Whether or not the transactions contemplated by this Agreement are consummated, each party shall pay all expenses incurred by it or on its behalf in connection with the Agreement and the transactions contemplated hereby, except as otherwise provided in the event of a breach by a party.

12.9 No Third Parties Benefited. No person other than Buyer and Seller and their permitted successors and assigns shall have any right of action under this Agreement.

12.10 Waivers. No waiver by either party of any provision shall be deemed a waiver of any other provision or of any subsequent breach by either party of the same or any other provision.

12.11 Captions. The captions and numbers of the Articles and Sections of this Agreement are for convenience and in no way define or limit the scope or intent of this Agreement.

12.12 Counterparts. This Agreement may be executed in counterparts, each of which shall be deemed an original but all of which, together, shall constitute one Agreement.

12.13 Exhibits. The Exhibits attached to this Agreement are hereby incorporated herein and made a part hereof by this reference.

12.14 Not Recordable. This Agreement shall not be recorded and shall not be a lien against the Property.

12.15 No Merger. The delivery of the Deed and any other documents and instruments by Seller and the acceptance and recordation thereof by Buyer shall not effect a merger, and the representations and warranties made in Sections 6.1 and 6.2 hereof by Seller and Buyer, respectively, shall survive the Close of Escrow.

12.16 California Withholding Requirement. If Seller fails to deliver a Resident Certificate, Seller acknowledges and agrees that Escrow Holder shall be entitled to: (i) withhold from the amount due Seller an amount equal to three and one-third percent (3-1/3%) of its share of the Purchase Price; and (ii) pay such withheld amounts to the Franchise Tax Board of California within twenty (20) days following the Close of Escrow.

12.17 Confidentiality and Return of Documents. Seller and Buyer shall each maintain as confidential, and neither party shall directly or indirectly use or disclose, any "Confidential Information", (as defined hereafter) concerning the Property, the other party, the other party's assets or the transactions contemplated by this Agreement to any person except that such matters may be disclosed (i) to such party's directors, officers, partners, and employees (ii) to such party's legal counsel, lenders,

accountants, engineers, architects, financial advisors and similar professionals and consultants to the extent such party deems it reasonably necessary or appropriate in connection with the evaluation of the transaction contemplated hereby or Buyer's development and use of the Property after Closing; (iii) by Seller to third parties having an ownership interest in or relationship with the Property (such as existing mortgagees) to whom disclosure is necessary or desirable in order to facilitate the consummation of the transactions contemplated hereby; (iv) pursuant to the order or regulation of any applicable court or regulatory agency; and (v) by Buyer after Closing to potential tenants, investors, lenders and purchasers of the Property. The parties referred to in (i) and (ii) above are referred to herein as "Seller's Representative" or "Buyer's Representative," as applicable. Neither Seller nor Buyer shall disclose any Confidential Information to Seller's or Buyer's Representatives, as applicable, until such times as Seller's or Buyer's Representatives acknowledge that they understand and agree to be bound by the provisions of this Section 12.17. Buyer and/or Seller shall each be responsible for any disclosure of any Confidential Information by their respective Buyer's or Seller's Representatives. For the purpose of this Section 12.17, the term "Confidential Information" shall mean information which is or becomes known to a party or its respective affiliates or to their employees, former employees, consultants or others in a confidential relationship with such party, including, without limitation, pursuant to the terms of this Agreement, and which relates to the Property, the transactions contemplated by this Agreement or the business of either party; provided, however, that confidential information shall not include: (i) information that is or becomes generally available to the public other than through a violation of law or obligation hereunder; (ii) information that, in the opinion of counsel to either party, such party is required by law, court order, government order or decree to disclose, except that the other party may at its own expense appeal such court order; (iii) information that was developed by such party on its own, independent from the proprietary information made available to such party hereunder; and (iv) information that was subsequently made available to such party by a third party who was not violating the law or any obligation hereunder in making such disclosure. In the event this Agreement is terminated, Buyer shall promptly return to Seller all documents, agreements, reports and other materials of any kind that have been delivered to Buyer by Seller pursuant to the terms of this Agreement. Following the Closing, Confidential Information shall be limited to the Purchase Price of the Property. Further, no press release or public announcement of any kind shall be made by either party hereunder concerning the purchase and sale transaction that is the subject of this Agreement, without the prior written approval of the other party.

IN WITNESS WHEREOF, the parties have executed this Purchase and Sale Agreement on the dates set forth below.

BUYER:

RNM CADER L.L.C., a California limited liability company

By: RNM PETALUMA, INC., a California corporation, its Manager

Dated: September 15, 2000

By: _____
John R. McNulty
Its: President

SELLER:

SOLA INTERNATIONAL, INC.,
a Delaware corporation

By: _____
Steven Neil
Its: CFO
Chief Financial Officer

Dated: September 15, 2000

EXHIBIT A
Legal Description Parcel "A"

Being a portion of Parcel Three and a portion of Parcel Two as said parcels are shown on that map titled City of Petaluma Parcel Map No. 118, filed in the office of the County Recorder in Book 255 of Maps, Page 39, Sonoma County Records, and more particularly described as follows:

Commencing at a point marked by an iron pipe, being the Northwesterly corner of Parcel One as said parcel is designated upon that certain Record of Survey filed in Book 518 of Maps, Page 11, Sonoma County Records; running thence South 54° 00' 27" East, 52.29 feet to the True Point of **Beginning**;

Thence continuing South 54° 00' 27" East, 709.10 feet to a point marked by an iron pipe, being the most Easterly corner of Parcel Three as designated on said map;
Thence continuing South 54° 00' 27" East, 263.89 feet to the Southeasterly boundary of Parcel Two as designated on said map;
Thence South 36° 00' 13" West, 869.30 feet to a point marked by an iron pipe, being the most Southerly corner of said Parcel Two;
Thence North 53° 59' 34" West, 264.06 feet to a point marked by an iron pipe, being the most southerly corner of said Parcel Three;
Thence continuing North 53° 59' 34" East, 760.91 feet;
Thence North 35° 59' 01" East, 780.13 feet; to the beginning of a curve;
Thence along said non-tangent curve concave northwesterly from which a tangent bears South 87° 13' 46" West, with a radius of 57.00 feet, through a central angle of 61° 16' 46" for a length of 60.96 feet;
Thence North 78° 40' 26" East, 46.96 feet to the True point of **Beginning**.

Excepting there from any interest conveyed by that certain grant deed dedication of right of way from Sola Optical U.S.A., Inc., a California Corporation, to the City of Petaluma, a Municipal Corporation, dated November 19, 1986 and recorded January 2, 1987 under Document No. 87-000244, Sonoma County Records.

Containing 20.41 acres
APN. 005-040-047

This description was prepared under my direct supervision for SOLA holdings in June of 2000 and is based on the above referenced Record of Survey.

Michael R. Hogan, PLS 7362 — Date 9/3/00

LICENSED LAND SURVEYOR
MICHAEL R. HOGAN
EXP. 12/31/01
NO. L.S. 7362
STATE OF CALIFORNIA

EXHIBIT B

RECORDING REQUESTED BY
AND WHEN RECORDED MAIL TO:

_____
_____
_____
_____
Attn: _____

GRANT DEED

FOR VALUABLE CONSIDERATION, receipt of which is hereby acknowledged, SOLA INTERNATIONAL, INC., a Delaware corporation, hereby GRANTS to RNM CADER L.L.C., a California limited liability company, that certain real property located in the City of Petaluma, County of Sonoma, State of California, and described on Exhibit A attached hereto and by this reference incorporated herein (the "Property").

Dated: _____, 2000

SOLA INTERNATIONAL, INC.,
a Delaware corporation

By:_____
Its: _____

CALIFORNIA ALL-PURPOSE ACKNOWLEDGMENT

STATE OF CALIFORNIA)
) Ss:
COUNTY OF SAN MATEO)

On _____, 200_, before me,_____, Notary Public, personally appeared
, personally known to me to or proved to me on the basis of satisfactory evidence to be the person(s) whose name(s) is/are subscribed to the within instrument and acknowledged to me that he/she/they executed the same in his/her/their authorized capacity(is), and that by his/her/their signature(s) on the instrument the person(s), or the entity upon behalf of which the person(s) acted, executed the instrument.

WITNESS my hand and official seal.

_____ (SEAL)
Notary Public Signature

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Appendix B

Documents Reviewed

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Appendix B
Documents Reviewed

California Department of Public Health. 2010. *Table of MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants*. last updated April 14, 2010.

California Department of Toxic Substance Control (DTSC). 2005. *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air.* 2004, updated February 2005.

California Environmental Protection Agency (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA). 1992. *Expedited Cancer Potency Values and Proposed Regulatory Levels for Certain Proposition 65 Carcinogens.* April.

_____. 2009. *Technical Support Document for Cancer Potency Factors: Methodologies for derivation, listing of available values, and adjustments to allow for early life stage exposures.* May.

_____. 2010. Online Toxicity Database - http://www.oehha.ca.gov/risk/ChemicalDB/index.asp, accessed May 10, 2010.

California Regional Water Quality Control Board San Francisco Region (Water Board). 2008. *Groundwater Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater – Interim Final*. November 2007, updated May 2008.

County of Sonoma Department of Health Services – Environmental Health Division (CSDHS-EHD). 2008. *Letter from CSDHS-EHD to constituents within ¼ mile of the Sola Site regarding Notice of Potential Groundwater Contamination.* November 6.

Harvest Christian School (HCS). 2007. Conditional Use Permit Application submitted by Harvest Christian School to City of Petaluma – Community Development Department regarding the relocation of a private school to 1500 Cader Lane. August 24.

Levine Fricke (LFR). 2005. *Groundwater Monitoring and Additional Site Activities Report, May 2003 through May 2005, Former Sola Optical USA, Inc., Facility, 1500 Cader Lane, Petaluma, California.* June 9.

_____. 2006. *Groundwater Monitoring and Additional Site Activities Report, October 2005 through June 2006, Former Sola Optical USA, Inc., Facility, 1500 Cader Lane, Petaluma, California.* August 21.

_____. 2007a. *Groundwater Monitoring and Additional Site Activities Report, July through December 2006, Former Sola Optical USA, Inc., Facility, 1500 Cader Lane, Petaluma, California.* February 9.

_____. 2007b. *Response to United State Environmental Protection Agency, Region 9, May 18, 2007 Letter Regarding Abandonment of Selected Groundwater Monitoring and Former Extraction Wells at the Former Sola Optical USA, Inc., Facility, 1500 Cader Lane, Petaluma, California.* June 7.

_____. 2007c. *Abandonment and Sealing of Wells at Former Sola Optical U.S.A., Inc., 1500 Cader Lane, Petaluma, California.* August 20.

_____. 2008a. *Groundwater Monitoring and Additional Site Activities Report, January through May 2008, Former Sola Optical USA, Inc., Facility, 1500 Cader Lane, Petaluma, California.* September 2.

_____. 2008b. *Groundwater Monitoring Report, June through November 2008, Former Sola Optical USA, Inc., Facility, 1500 Cader Lane, Petaluma, California.* December 12.

LFR/Arcadis. 2009. *Groundwater Monitoring Report, January through June 2009, Former Sola Optical USA, Inc., Facility, 1500 Cader Lane, Petaluma, California.* September 1.

RNM Cader, L.L.C. and Sola International, Inc. 2000. *Purchase and Sales Agreement*. September 15.

United States Environmental Protection Agency (EPA). 1991. *Record of Decision; Sola Optical Site*. September 27.

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Appendix C

Five-Year Review Site Inspection Checklist

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Appendix C
Five-Year Review Site Inspection Checklist

Table C-1
Site Inspection Team Roster
Site Inspection- March 17, 2010
Sola Optical USA, Inc.,Sonoma County, CA

Name	Title	Affiliation
Daren Roth	Project Geologist	Arcadis
Peggy Bloisa	Professional Geologist	CDM Walnut Creek Office
Ahnna Westrich	Staff Geologist	CDM Walnut Creek Office

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Site Inspection Checklist

I. SITE INFORMATION	
Site name: Sola Optical	**Date of inspection:** 3/17/2010
Location and Region: Petaluma, CA, Region 9	**EPA ID:** CAD981171523
Agency, office, or company leading the five-year review: EPA Region 9	**Weather/temperature:** Sunny – approximately 65 degrees F

Remedy Includes: (Check all that apply)

- ☐ Landfill cover/containment
- ☐ Access controls
- ✓ Institutional controls
- ☐ Groundwater pump and treatment
- ☐ Surface water collection and treatment
- ☐ Other_____
- ✓ Monitored natural attenuation
- ☐ Groundwater containment
- ☐ Vertical barrier walls

Attachments: ✓ Inspection team roster attached ✓ Site map attached

II. INTERVIEWS (Check all that apply)

1. **O&M site manager** _____
   Name Title Date
   Interviewed ☐ at site ☐ at office ☐ by phone Phone no. _____
   Problems, suggestions; ☐ Report attached _____

2. **O&M staff** Daren Roth Project Geologist March 17, 2010
   Name Title Date
   Interviewed ✓ at site ☐ at office ☐ by phone Phone no. (510) 596-9558
   Problems, suggestions; ✓ Report attached _____

3. **Local regulatory authorities and response agencies** (i.e., State and Tribal offices, emergency response office, police department, office of public health or environmental health, zoning office, recorder of deeds, or other city and county offices, etc.) Fill in all that apply.

Agency Sonoma County Permit and Resource Management Department – Wells and Septic Division
Contact Bob Swift (Name) Supervising Environmental Health Specialist (Title) March 31, 2010 (Date) (707) 565-1680 (Phone no.)
Problems; suggestions; ✓ Report attached _____

Agency Sonoma County Environmental Health Department
Contact John Anderson (Name) Senior Environmental Health Specialist III (Title) March 31, 2010 (Date) (707) 565-6534 (Phone no.)
Problems; suggestions; ✓ Report attached _____

Agency Regional Water Quality Control Board – San Francisco Bay
Contact John Jang (Name) Caseworker (Title) April 1, 2010 (Date) (510) 622-2366 (Phone no.)
Problems; suggestions; ✓ Report attached _____

Agency _____
Contact _____ (Name) _____ (Title) _____ (Date) _____ (Phone no.)
Problems; suggestions; ☐ Report attached _____

4. **Other interviews** (optional) ✓ Report attached.

Jamie Milliner – RNM Properties

Scott Seyfried – Arcadis Project Manager

Hahn Nguyen – Carl Zeiss Vision (CDM contacted Mr. Nguyen on March 29, 2010. CDM has yet to hear a response.)

III. ON-SITE DOCUMENTS & RECORDS VERIFIED (Check all that apply)

1. **O&M Documents**
   - ☐ O&M manual — ☐ Readily available — ☐ Up to date — ✓ N/A
   - ☐ As-built drawings — ☐ Readily available — ☐ Up to date — ✓ N/A
   - ☐ Maintenance logs — ☐ Readily available — ☐ Up to date — ✓ N/A

   Remarks_____

2. **Site-Specific Health and Safety Plan** — ☐ Readily available — ☐ Up to date — ☐ N/A
   - ☐ Contingency plan/emergency response plan — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks Health and safety plan applies to the current site activities (groundwater monitoring events) and conditions.

3. **O&M and OSHA Training Records** — ☐ Readily available — ✓ Up to date — ☐N/A

   Remarks HAZWOPER certifications and medical monitoring

4. **Permits and Service Agreements**
   - ☐ Air discharge permit — ☐ Readily available — ☐ Up to date — ✓ N/A
   - ☐ Effluent discharge — ☐ Readily available — ☐ Up to date — ✓ N/A
   - ☐ Waste disposal, POTW — ☐ Readily available — ☐ Up to date — ✓ N/A
   - ☐ Other permits_____ — ☐ Readily available — ☐ Up to date — ☐ N/A

   Remarks Mr. Roth stated that there are no permits for the property.

5. **Gas Generation Records** — ☐ Readily available — ☐ Up to date — ✓ N/A

   Remarks_____

6. **Settlement Monument Records** — ☐ Readily available — ☐ Up to date — ✓ N/A

   Remarks_____

7. **Groundwater Monitoring Records** — ☐Readily available — ✓ Up to date — ☐ N/A

   Remarks_____

8. **Leachate Extraction Records** — ☐ Readily available — ☐ Up to date — ✓ N/A

   Remarks_____

9. **Discharge Compliance Records**
   - ☐ Air — ☐Readily available — ☐ Up to date — ✓ N/A
   - ☐ Water (effluent) — ☐ Readily available — ☐ Up to date — ✓ N/A

   Remarks_____

10. **Daily Access/Security Logs** — ☐ Readily available — ☐ Up to date — ✓ N/A

    Remarks When a groundwater sampling event occurs, the Arcadis field technician checks in at the Site office building and contacts RNM Properties to have the gate located on the adjacent lot opened. The Arcadis field technician locks the gate when the groundwater sampling activities are complete.

IV. O&M COSTS

1. **O&M Organization**

☐ State in-house ☐ Contractor for State
☐ PRP in-house ✓ Contractor for PRP (Arcadis, formerly LFR)
☐ Federal Facility in-house ☐ Contractor for Federal Facility
☐ Other_____

2. **O&M Cost Records – Daren will check on and provide to CDM**

☐ Readily available ☐ Up to date
☐ Funding mechanism/agreement in place
Original O&M cost estimate_____ ☐ Breakdown attached

Total annual cost by year for review period if available

From 2005 Date	To 2006 Date	$ 14,5000 Total cost	☐Breakdown attached	
From 2006 Date	To 2007 Date	$ 14,5000 Total cost	☐ Breakdown attached	
From 2007 Date	To 2008 Date	$ 14,5000 Total cost	☐ Breakdown attached	
From 2008 Date	To 2009 Date	$ 14,5000 Total cost	☐ Breakdown attached	
From 2009 Date	To 2010 Date	$ 14,5000 Total cost	☐ Breakdown attached	

3. **Unanticipated or Unusually High O&M Costs During Review Period**

Describe costs and reasons: _____

V. ACCESS AND INSTITUTIONAL CONTROLS ☐ Applicable ☐ N/A

A. Fencing

1. **Fencing damaged** ☐ Location shown on site map ✓ Gates secured ☐N/A

Remarks Neither the main lot or the RNM lot is completely fenced. The main lot is only fenced along the southeast property boundary. There is no fence present between the main lot and the RNM lot, but there is a landscaped berm present along a portion of the boundary. The northwest property boundary of the RNM lot (along Cader Lane) is fenced and the gates were secured at the time of the inspection.

B. Other Access Restrictions

1. **Signs and other security measures** ☐ Location shown on site map ☐ N/A

Remarks Sign with name and phone number of the security company (Weinstein Security) was present on the gate on the RNM lot. Signs indicating construction activities on the RNM lot were also present.

C. Institutional Controls (ICs)

1. **Implementation and enforcement**

Site conditions imply ICs not properly implemented ☐ Yes ✓ No ☐ N/A
Site conditions imply ICs not being fully enforced ☐ Yes ✓ No ☐ N/A

Type of monitoring (*e.g.*, self-reporting, drive by) _____
Frequency _____
Responsible party/agency _____
Contact _____ _____ _____ _____
Name Title Date Phone no.

Reporting is up-to-date ☐ Yes ☐ No ✓ N/A
Reports are verified by the lead agency ☐ Yes ☐ No ✓ N/A

Specific requirements in deed or decision documents have been met ☐ Yes ☐ No ✓ N/A
Violations have been reported ☐ Yes ☐ No ✓ N/A
Other problems or suggestions: ☐ Report attached

_____
_____
_____
_____

2. **Adequacy** ☐ ICs are adequate ✓ ICs are inadequate ☐ N/A

Remarks The ICs for the Site include a restrictive covenant with the property owner to restrict groundwater uses that could result in unacceptable exposure to humans or the environment (EPA, 2007). The second control exists within Sonoma County's well permitting process. During the Site visit, the site conditions did not imply that the ICs were not properly implemented or that the ICs were not being fully enforced. Since concentrations of 1,1-DCA in groundwater samples collected from well W-27 are currently above its maximum contaminant level (MCL) of 5 micrograms per liter (µg/L), these ICs continue to be necessary. See comments under Section XI C regarding adequacy of ICs.

_____

D. General

1. **Vandalism/trespassing** ☐ Location shown on site map ✓ No vandalism evident

Remarks Mr. Roth was unaware of any vandalism.

2. **Land use changes on site** ☐N/A

Remarks An asphalt parking lot and four building pads have been constructed on the RNM lot. W-27, located in the asphalt parking lot, has been converted from an above-grade well to a flush-mounted well.

_____

3. **Land use changes off site** ✓ N/A

Remarks_____
_____

VI. GENERAL SITE CONDITIONS

A. Roads ✓ Applicable ☐ N/A

1. **Roads damaged** ✓ Location shown on site map ✓ Roads adequate N/A

Remarks_____
_____

B. Other Site Conditions

Remarks W-27 located on the RNM lot and extraction wells E-1, E-2, and E-4 in the main lot appear to be secure and undamaged.

VII. LANDFILL COVERS ☐ Applicable ✓ N/A

A. Landfill Surface

1. **Settlement** (Low spots) ☐ Location shown on site map ☐Settlement not evident
Areal extent_____ Depth_____
Remarks_____

2. **Cracks** ☐Location shown on site map ☐Cracking not evident
Lengths_____ Widths_____ Depths_____
Remarks_____

3. **Erosion** ☐Location shown on site map ☐ Erosion not evident
Areal extent_____ Depth_____
Remarks_____

4. **Holes** ☐ Location shown on site map ☐ Holes not evident
Areal extent_____ Depth_____
Remarks_____

5. **Vegetative Cover** ☐ Grass ☐Cover properly established ☐ No signs of stress
☐ Trees/Shrubs (indicate size and locations on a diagram)
Remarks_____

6. **Alternative Cover (armored rock, concrete, etc.)** ☐ N/A
Remarks_____

7. **Bulges** ☐ Location shown on site map Bulges not evident
Areal extent_____ Height_____
Remarks_____

8. **Wet Areas/Water Damage** ☐ Wet areas/water damage not evident
☐ Wet areas ☐ Location shown on site map Areal extent_____
☐ Ponding ☐ Location shown on site map Areal extent_____
☐ Seeps ☐ Location shown on site map Areal extent_____
☐ Soft subgrade ☐ Location shown on site map Areal extent_____
Remarks_____
_____

9. **Slope Instability** ☐Slides ☐ Location shown on site map ☐ No evidence of slope instability
Areal extent_____
Remarks_____
_____

B. Benches ☐ Applicable ✓ N/A
(Horizontally constructed mounds of earth placed across a steep landfill side slope to interrupt the slope in order to slow down the velocity of surface runoff and intercept and convey the runoff to a lined channel.)

1. **Flows Bypass Bench** ☐Location shown on site map ☐ N/A or okay
Remarks_____
_____

2. **Bench Breached** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

3. **Bench Overtopped** ☐ Location shown on site map ☐ N/A or okay
Remarks_____
_____

C. Letdown Channels ☐ Applicable ✓ N/A
(Channel lined with erosion control mats, riprap, grout bags, or gabions that descend down the steep side slope of the cover and will allow the runoff water collected by the benches to move off of the landfill cover without creating erosion gullies.)

1. **Settlement** ☐ Location shown on site map ☐ No evidence of settlement
Areal extent_____ Depth_____
Remarks_____
_____

2. **Material Degradation** ☐ Location shown on site map ☐ No evidence of degradation
Material type_____ Areal extent_____
Remarks_____
_____

3. **Erosion** ☐Location shown on site map ☐No evidence of erosion
Areal extent_____ Depth_____
Remarks_____
_____

4. **Undercutting** ☐ Location shown on site map ☐No evidence of undercutting
Areal extent_____ Depth_____
Remarks_____
_____

5. **Obstructions** Type_____ ☐ No obstructions
☐ Location shown on site map Areal extent_____
Size_____
Remarks_____
_____

6. **Excessive Vegetative Growth** Type_____
☐ No evidence of excessive growth
☐ Vegetation in channels does not obstruct flow
☐ Location shown on site map Areal extent_____
Remarks_____
_____

D. Cover Penetrations ☐ Applicable ✓ N/A

1. **Gas Vents** ☐ Active ☐ Passive
☐ Properly secured/locked Functioning ☐ Routinely sampled ☐Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance
☐ N/A
Remarks_____
_____

2. **Gas Monitoring Probes**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

3. **Monitoring Wells** (within surface area of landfill)
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

4. **Leachate Extraction Wells**
☐ Properly secured/locked ☐ Functioning ☐ Routinely sampled ☐ Good condition
☐ Evidence of leakage at penetration ☐ Needs Maintenance ☐ N/A
Remarks_____
_____

5. **Settlement Monuments** ☐ Located ☐ Routinely surveyed ☐ N/A
Remarks_____
_____

E. Gas Collection and Treatment ☐ Applicable ✓ N/A

1. **Gas Treatment Facilities**
   ☐ Flaring ☐ Thermal destruction ☐Collection for reuse
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Gas Collection Wells, Manifolds and Piping**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Gas Monitoring Facilities** (*e.g.*, gas monitoring of adjacent homes or buildings)
   ☐ Good condition ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____

F. Cover Drainage Layer ☐ Applicable ✓ N/A

1. **Outlet Pipes Inspected** ☐ Functioning ☐ N/A
   Remarks_____
   _____

2. **Outlet Rock Inspected** ☐ Functioning ☐N/A
   Remarks_____
   _____

G. Detention/Sedimentation Ponds ☐Applicable ✓ N/A

1. **Siltation** Areal extent_____ Depth_____ ☐ N/A
   ☐ Siltation not evident
   Remarks_____
   _____

2. **Erosion** Areal extent_____ Depth_____
   ☐ Erosion not evident
   Remarks_____
   _____

3. **Outlet Works** ☐ Functioning ☐ N/A
   Remarks_____
   _____

4. **Dam** ☐ Functioning ☐ N/A
   Remarks_____
   _____

H. Retaining Walls ☐ Applicable ✓ N/A

1. **Deformations** ☐ Location shown on site map ☐ Deformation not evident
   Horizontal displacement_____ Vertical displacement_____
   Rotational displacement_____
   Remarks_____
   _____

2. **Degradation** ☐ Location shown on site map ☐ Degradation not evident
   Remarks_____
   _____

I. Perimeter Ditches/Off-Site Discharge ☐Applicable ✓ N/A

1. **Siltation** ☐ Location shown on site map ☐ Siltation not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Vegetative Growth** ☐ Location shown on site map ☐ N/A
   ☐ Vegetation does not impede flow
   Areal extent_____ Type_____
   Remarks_____
   _____

3. **Erosion** ☐ Location shown on site map ☐Erosion not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

4. **Discharge Structure** ☐Functioning ☐ N/A
   Remarks_____
   _____

VIII. VERTICAL BARRIER WALLS ☐ Applicable ✓ N/A

1. **Settlement** ☐Location shown on site map ☐Settlement not evident
   Areal extent_____ Depth_____
   Remarks_____
   _____

2. **Performance Monitoring** Type of monitoring_____
   ☐ Performance not monitored
   Frequency_____ Evidence of breaching
   Head differential_____
   Remarks_____
   _____

IX. GROUNDWATER/SURFACE WATER REMEDIES ☐ Applicable ✓ N/A

A. Groundwater Extraction Wells, Pumps, and Pipelines ☐ Applicable ✓ N/A

1. **Pumps, Wellhead Plumbing, and Electrical**
   ☐ Good condition ☐ All required wells properly operating ☐ Needs Maintenance ☐ N/A
   Remarks_____
   _____
   _____

2. **Extraction System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

B. Surface Water Collection Structures, Pumps, and Pipelines ☐ Applicable ✓ N/A

1. **Collection Structures, Pumps, and Electrical**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

2. **Surface Water Collection System Pipelines, Valves, Valve Boxes, and Other Appurtenances**
   ☐ Good condition ☐ Needs Maintenance
   Remarks_____
   _____

3. **Spare Parts and Equipment**
   ☐ Readily available ☐ Good condition ☐ Requires upgrade ☐ Needs to be provided
   Remarks_____
   _____

C. Treatment System ☐Applicable ✓ N/A

1. **Treatment Train** (Check components that apply)
   - ☐ Metals removal ☐ Oil/water separation ☐ Bioremediation
   - ☐ Air stripping ☐ Carbon adsorbers
   - ☐ Filters_____
   - ☐ Additive (*e.g.*, chelation agent, flocculent)_____
   - ☐ Others_____
   - ☐ Good condition ☐ Needs Maintenance
   - ☐ Sampling ports properly marked and functional
   - ☐ Sampling/maintenance log displayed and up to date
   - ☐ Equipment properly identified
   - ☐ Quantity of groundwater treated annually_____
   - ☐ Quantity of surface water treated annually_____

   Remarks_____

2. **Electrical Enclosures and Panels** (properly rated and functional)
   - ☐ N/A ☐ Good condition ☐Needs Maintenance

   Remarks_____

3. **Tanks, Vaults, Storage Vessels**
   - ☐ N/A ☐Good condition Proper secondary containment ☐Needs Maintenance

   Remarks_____

4. **Discharge Structure and Appurtenances**
   - ☐ N/A ☐ Good condition ☐Needs Maintenance

   Remarks_____

5. **Treatment Building(s)**
   - ☐ N/A ☐ Good condition (esp. roof and doorways) ☐ Needs repair
   - ☐Chemicals and equipment properly stored

   Remarks_____

6. **Monitoring Wells** (pump and treatment remedy)
   - ☐ Properly secured/locked ☐Functioning ☐ Routinely sampled ☐ Good condition
   - ☐All required wells located ☐Needs Maintenance ☐ N/A

   Remarks_____

D. Monitoring Data

1. Monitoring Data
   - ☐ Is routinely submitted on time ✓ Is of acceptable quality

   Data is validated in-house by Arcadis

2. Monitoring data suggests:
   - ☐ Groundwater plume is effectively contained ✓ Contaminant concentrations are declining

E. Monitored Natural Attenuation

1. **Monitoring Wells** (natural attenuation remedy)
☐ Properly secured/locked ✓ Functioning ✓ Routinely sampled ✓ Good condition
✓ All required wells located ☐ Needs Maintenance ☐ N/A
Remarks The depth to water is measured on a semi-annual basis at W-27 and extraction wells E-1, E-2, and E-4. A groundwater sample is collected from W-27 on a semi-annual basis.

X. OTHER REMEDIES

If there are remedies applied at the site which are not covered above, attach an inspection sheet describing the physical nature and condition of any facility associated with the remedy. An example would be soil vapor extraction.

XI. OVERALL OBSERVATIONS

A. Implementation of the Remedy

Describe issues and observations relating to whether the remedy is effective and functioning as designed. Begin with a brief statement of what the remedy is to accomplish (i.e., to contain contaminant plume, minimize infiltration and gas emission, etc.).
Currently, the remedy at the property is monitored natural attenuation of 1,1-dichloroethane (1,1-DCA) at well W-27 to below its MCL of 5 µg/L and institutional controls to prevent the installation of additional groundwater wells onsite. Since 2005, groundwater samples have been collected from W-27 on a semi-annual basis and analyzed for volatile organic compounds.

B. Adequacy of O&M

Describe issues and observations related to the implementation and scope of O&M procedures. In particular, discuss their relationship to the current and long-term protectiveness of the remedy.
The ICs for the Site include a restrictive covenant with the property owner to restrict groundwater uses that could result in unacceptable exposure to humans or the environment (EPA, 2007). The second control exists within Sonoma County's well permitting process. During the Site visit, the site conditions did not imply that the ICs were not properly implemented or that the ICs were not being fully enforced. Since concentrations of 1,1-DCA in groundwater samples collected from W-27 are currently above its MCL, these ICs continue to be necessary. Monitoring is the only activity that occurs on-Site, therefore the O&M is limited.

C.	Early Indicators of Potential Remedy Problems
	Describe issues and observations such as unexpected changes in the cost or scope of O&M or a high frequency of unscheduled repairs, that suggest that the protectiveness of the remedy may be compromised in the future. On March 31, 2010, CDM conducted a telephone interview with Bob Swift, the Supervising Environmental Health Specialist for the Sonoma County Permit and Resource Management Department – Wells and Septic Division (PRMD). Mr. Swift indicated that the Wells and Septic Division of the PRMD reviews permit applications for the installation of water supply and agricultural wells. At the request of CDM, Mr. Swift conducted a search of the Permit Plus system for the 1500 Cader Lane address. Per the 2007 ROD Amendment, the EPA asked the PRMD to place a note in the Permit Plus system regarding the Site parcel that lies directly above the contaminated groundwater. This note should state that the parcel is part of a Superfund site and that well permits should not be issued before consulting with PRMD and EPA. This notation should be seen by anyone applying for a well permit on the Site. According to Mr. Swift, when he conducted a search of the Permit Plus system for the Site, the aforementioned text was not present. Therefore, steps should be taken to ensure that the Permits Plus IC is put in place.
D.	**Opportunities for Optimization**
	Describe possible opportunities for optimization in monitoring tasks or the operation of the remedy. Monitoring has been continually optimized in the past with reductions in the number of wells that are sampled. Between 2005 and 2007, (E-3, E-5, W-25, and W-27) were sampled for volatile organic compounds (VOCs). In July 2007, E-3, E-5, and W-25 were destroyed. Except for the groundwater sample collected in May 2009, the concentrations of 1,1-DCA in groundwater samples collected from well W-27 have remained above the MCL.

Appendix D

Site Inspection Photographs

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Site Inspection Photographs
Sola Optical USA, INC. Superfund Site – Third Five-Year Review Report
1500 Cader Lane, Petaluma, CA
Date of Photographs: March 17, 2010

Photograph 1: View of former GWET location facing northeast.

Photograph 2: View of former UST location facing northeast.

Photograph 3: View of extraction wells E-1 and E-2 facing northwest.

Photograph 4: View of extraction well E-4 facing northwest.

Photograph 5: View of groundwater monitoring well W-27 and the asphalt parking lot on the RNM lot facing southwest.

Photograph 6: View of asphalt parking lot and building pad on the RNM lot facing south.

Photograph 7: View of access gate and security company sign on the RNM lot facing southeast.

Appendix E

Five-Year Review Interview Forms

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INTERVIEW DOCUMENTATION FORM			
The following is a list of individual interviewed for this five-year review. See the attached contact record(s) for a detailed summary of the interviews.			
Name	**Title/Position**	**Organization**	**Date**
Daren Roth	Project Geologist	Arcadis	March 17, 2010
Ken Tran	Building Manager/Owner	Kland, LLC	March 29, 2010
Jamie Milliner	Project Manager	RNM Properties	March 29, 2010
John Anderson	Senior Environmental Health Specialist III	Sonoma County Environmental Health Department	March 31, 2010
Bob Swift	Supervising Environmental Health Specialist	Sonoma County Permit and Resource Management Department – Wells and Septic Division	March 31, 2010
John Jang	Caseworker	California Regional Water Quality Control Board – San Francisco Bay	April 1, 2010
Scott Seyfried	Project Manager	Arcadis	April 2, 2010
Hahn Nguyen	Sr. Accounting Manger	Carl Zeiss Vision	Interview yet to be conducted as of 4/2/10

INTERVIEW RECORD

Site Name: Sola Optical		**EPA ID No.:** CAD981171523
Subject: Site Activities from 2005 to 2010		**Time:** 10:00 **Date:** 3/17/10
Type: ☐ Telephone **X** Visit ☐ Other **Location of Visit:** 1500 Cader Lane, Petaluma, California		☐ Incoming ☐ Outgoing
Contact Made By:		
Name: Ahnna Westrich	**Title:** Staff Geologist	**Organization:** Camp, Dresser & McKee, Inc. (CDM)
Individual Contacted:		
Name: Daren Roth	**Title:** Project Geologist	**Organization:** Arcadis
Telephone No: (510) 596-9558 **Fax No:** (510) 652-2246 **E-Mail Address:** daren.roth@arcadis-us.com		**Street Address:** 1900 Powell Street, 12th Floor **City, State, Zip:** Emeryville, CA 94608

Summary of Conversation

Daren Roth is a project geologist with Arcadis. He has been involved with the site in one aspect or another since May 2005 and sampled the groundwater at the site through 2007. He took over the task management role in 2009.

1. **Is the remedy functioning as expected? How well is the remedy performing?**
   - Yes.
2. **What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?**
   - According to Mr. Roth, the groundwater analytical results for well W-27 have remained above the MCL (5 micrograms per liter (µg/L) for 1,1-DCA, except for the groundwater sample collected during the May 2009 monitoring event when the concentration was 4.7 µg/L, just below the MCL. In December 2009, with a concentration of 6.5 µg/L, the groundwater sample collected from well W-27 exceeded the MCL.
3. **Is there a continuous on-site O&M presence? If so, please describe staff and activities. If there is not a continuous on-site present, describe staff and frequency of site inspections and activities.**
   - There is no continuous on-site O&M presence. Arcadis conducts groundwater sampling on a semi-annual basis.
4. **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.**
   - Mr. Roth stated that the only change in the site activities has been a decrease in the number of wells present on Site. In 2007, LFR requested approval from the EPA to abandon groundwater monitoring wells W-22, W-25, and LF-2 and extraction wells E-3, E-5, and E-7, since 1,1-DCA in samples from these wells had reached and remained below the maximum contaminant level (MCL) for two years. LFR obtained approval from the EPA to abandon these 6 wells and they were destroyed in July 2007.
5. **Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give detail.**
   - Mr. Roth indicated that there have not been any difficulties or additional costs with respect to

operation and maintenance (O&M) within the last five years. Mr. Roth indicated that, since 2005, the annual O&M costs were $14,500.

6. **Have there been opportunities to optimize O&M, or sampling efforts? Please describe changes and resultant or desired cost savings or improved efficiency.**
    - No.
7. **Do you have any comments suggestions or recommendations regarding the project?**
    - No.
8. **Anyone else we should interview?**
    - Mr. Roth indicated that we should talk to Scott Seyfried, the Site project manager from Arcadis.

INTERVIEW RECORD

Site Name: Sola Optical	**EPA ID No.:** CAD981171523	
Subject: Site Activities from 2005 to 2010	**Time:** 16:30	**Date:** 3/29/10
Type: **X** Telephone ☐ Visit ☐ Other **Location of Visit:**	☐ Incoming **X** Outgoing	

Contact Made By:

Name: Ahnna Westrich	**Title:** Staff Geologist	**Organization:** Camp, Dresser & McKee, Inc. (CDM)

Individual Contacted:

Name: Ken Tran	**Title:** Site Building Manager/Part Owner	**Organization:** Kland, LLC
Telephone No: (707) 542-5888 **Fax No:** (707) 542-5810 **E-Mail Address:** kenkland@aol.com	**Street Address:** 5800 River Road **City, State, Zip:** Santa Rosa, CA 95401	

Summary of Conversation

1. What is your role with respect to the Site?

- Mr. Tran is the site building manager and part owner for the 1500 Cader Lane property (active building). Mr. Tran and Kland, LLC have owned the property since 2002. Mr. Tran stated that the current tenants of the building on the property are: Petaluma Poultry, a tenant for six years whose site operations include sales and distribution; Reynolds Packaging, a tenant for five years whose site operations include storage and distribution of food packaging materials, and Scott Laboratories, a tenant for seven years whose site operations include the manufacturing and finishing of cork for the wine industry.
- Mr. Tran indicated that he is aware of when the groundwater sampling activities occur, has received copies of the groundwater monitoring reports, and is familiar with the restrictive covenant for the property. Mr. Tran mentioned that the property was re-financed in 2009. As a result, the bank required that a Phase I Environmental Site Assessment (ESA) be conducted on the property (1500 Cader Lane). The results of the Phase I ESA indicated that the property was clean and that there was no action required. Mr. Tran does not have a copy of the Phase I ESA Report.

2. What construction activities have occurred on the Site since 2005?

- Mr. Tran stated that there have not been any inspections, construction, or vandalism on the property since 2005.

3. Do you have any comments suggestions or recommendations regarding the project?

- No.

4. Anyone else we should interview?

- No.

INTERVIEW RECORD

Site Name: Sola Optical		**EPA ID No.:** CAD981171523
Subject: Site Activities from 2005 to 2010		**Time:** 15:00 **Date:** 3/29/10
Type: **X** Telephone ☐ Visit ☐ Other **Location of Visit:**		**X** Incoming ☐ Outgoing

Contact Made By:

Name: Ahnna Westrich	**Title:** Staff Geologist	**Organization:** Camp, Dresser & McKee, Inc. (CDM)

Individual Contacted:

Name: Jamie Milliner	**Title:** Project Manager	**Organization:** RNM Properties
Telephone No: (707) 781-2602 **Fax No:** **E-Mail Address:** jmilliner@rnmproperties.com		**Street Address:** 1600 Corporate Circle **City, State, Zip:** Petaluma, CA 94954

Summary Of Conversation

1. What is your knowledge of the Site?

- Jamie Milliner is the Director of Project Management for RNM Properties, owner of the 11 auxiliary acres (RNM lot) located southwest of the 1500 Cader Lane property.

2. What construction activities have occurred on the RNM lot since 2005?

a. Site activities on the RNM lot include the construction of four building pads in 2004/2005 (350,000 ft^2) and the construction of the asphalt parking lot and installation of the below grade utilities infrastructure in 2007/2008.

3. Have there been any restrictions on construction with respect to the ROD amendment?

- Mr. Milliner stated that there are no restrictions on development and construction activities on the RNM lot. RNM has a development agreement with the City of Petaluma to proceed with construction activities on their lot. In order to keep the permits and entitlement active, entitlement maintenance (footings) and uniform building code (UBC) inspections have been conducted by the City of Petaluma twice a year since 2008 and will continue until 2012. Mr. Milliner indicated that per the development agreement RNM Properties will construct one building on the RNM lot within the next five years.

4. Do you have any comments suggestions or recommendations regarding the project?

- No.

5. Anyone else we should interview?

- No.

INTERVIEW RECORD

Site Name: Sola Optical		**EPA ID No.:** CAD981171523
Subject: Site Activities from 2005 to 2010		**Time:** 11:00 **Date:** 3/31/10
Type: **X** Telephone ☐ Visit ☐ Other **Location of Visit:**		**X** Incoming ☐ Outgoing

Contact Made By:

Name: Ahnna Westrich	**Title:** Staff Geologist	**Organization:** Camp, Dresser & McKee, Inc. (CDM)

Individual Contacted:

Name: John Anderson, R.E.H.S.	**Title:** Senior Environmental Health Specialist III	**Organization:** Sonoma County Environmental Health Division
Telephone No: (707) 565-6534 **Fax No:** (707) 565-6525 **E-Mail Address:** janderso@sonoma-county.org		**Street Address:** 475 Aviation Blvd., Suite 220 **City, State, Zip:** Santa Rosa, CA 95403

Summary Of Conversation

Mr. Anderson is a Senior Environmental Health Specialist III with the Sonoma County Environmental Health Division (SCEHD).

1. **CDM contacted the Sonoma County Environmental Health Department to discuss the Institutional Control regarding monitoring well permit applications.**

    - The Sonoma County Environmental Health Division (SCEHD) reviews applications for the installation of groundwater monitoring wells. Mr. Anderson believes that the property located at 1500 Cader Lane in Petaluma, California (Site) is overseen by the Regional Water Quality Control Board – San Francisco Bay (Water Board).

    - Mr. Anderson stated that the SCEHD reviews applications for the installation of groundwater monitoring wells. He also indicated that when a groundwater monitoring well application is submitted to the SCEHD, a work plan is also submitted to, and reviewed by, either the Water Board or the Department of Toxic Substances Control (DTSC). The SCEHD also reviews the field work details within the work plan. Therefore, if a groundwater monitoring well application is submitted for the Site, the SCEHD would be able to determine that the application was for a Superfund site.

2. **What is your relationship with the Site? Are there any files on record for the Site?**

    - Mr. Anderson stated that since 2005, he has had a minimal relationship with the Site and is unaware of Site activities. There have not been any complaints or violations with respect to the Site.

    - Mr. Anderson indicated that there were no records on file at the SCEHD for the Site and that the old address for the Site was 3600 Lakeville Highway. The SCEHD had one permit on file for the 3600 Lakeville Highway address. This permit, submitted in 2007, was for the destruction of 6 wells on the Site.

3. **Has a site inspection been conducted at the Site?**

    - Mr. Anderson stated that he has not visited or inspected the Site in recent years, but that a Site visit may have been conducted by the SCEHD in association with the well destruction in 2007.

INTERVIEW RECORD

Site Name: Sola Optical	**EPA ID No.:** CAD981171523	
Subject: Site Activities from 2005 to 2010	**Time:** 13:30	**Date:** 3/31/10
Type: **X** Telephone ☐ Visit ☐ Other **Location of Visit:**	**X** Incoming ☐ Outgoing	

Contact Made By:

Name: Ahnna Westrich	**Title:** Staff Geologist	**Organization:** Camp, Dresser & McKee, Inc. (CDM)

Individual Contacted:

Name: Bob Swift	**Title:** Supervising Environmental Health Specialist	**Organization:** Sonoma County Permit and Resource Management Department – Wells and Septic Division
Telephone No: (707) 565-1680 **Fax No:** **E-Mail Address:**		**Street Address:** 2550 Ventura Avenue **City, State, Zip:** Santa Rosa, CA 95403

Summary Of Conversation

Mr. Swift is the Supervising Environmental Health Specialist for the Sonoma County Permit and Resource Management Department (RRMD) – Wells and Septic Division.

1. **CDM contacted the Sonoma County Permit and Resource Management Department to confirm that the Institutional Control within the Permits Plus system was in place.**

    - Mr. Swift indicated that the Wells and Septic Division of the PRMD reviews permit applications for the installation of water supply and agricultural wells. At the request of CDM, Mr. Swift conducted a search of the Permit Plus system for the 1500 Cader Lane address. Per the 2007 ROD Amendment, the EPA asked the PRMD to place a note in the Permit Plus system regarding the Site parcel that lies directly above the contaminated groundwater. This note should state that the parcel is part of a Superfund site and that well permits should not be issued before consulting with PRMD and EPA. This notation should be seen by anyone applying for a well permit on the Site. According to Mr. Swift, when he conducted a search of the Permit Plus system for the Site, the aforementioned text was not present.

INTERVIEW RECORD

Site Name: Sola Optical		**EPA ID No.:** CAD981171523
Subject: Site Activities from 2005 to 2010		**Time:** 11:00 **Date:** 4/1/10
Type: **X** Telephone ☐ Visit ☐ Other **Location of Visit:**		**X** Incoming ☐ Outgoing

Contact Made By:

Name: Ahnna Westrich	**Title:** Staff Geologist	**Organization:** Camp, Dresser & McKee, Inc. (CDM)

Individual Contacted:

Name: John Jang	**Title:** Caseworker	**Organization:** Regional Water Quality Control Board – San Francisco Bay
Telephone No: (510) 622-2366 **Fax No:** (510) 622-2460 **E-Mail Address:** jjang@waterboards.ca.gov		**Street Address:** 1515 Clay Street, Suite 1400 **City, State, Zip:** Oakland, CA 94612

Summary Of Conversation

CDM contacted John Jang with the San Francisco Bay - Regional Water Quality Control Board to discuss the Institutional Controls for the Site.

1. What is your relationship with the Site? Are there any files on record for the Site?

- Mr. Jang indicated that the United States Environmental Protection Agency (EPA) is the lead agency with respect to the Sola Optical Site, and that since 2005 the Water Board has received copies of the groundwater monitoring reports, but has otherwise not been involved with activities at the Site.

INTERVIEW RECORD

Site Name: Sola Optical		**EPA ID No.:** CAD981171523
Subject: Site Activities from 2005 to 2010		**Time:** 10:00 **Date:** 4/2/10
Type: **X** Telephone ☐ Visit ☐ Other **Location of Visit:**		**X** Incoming ☐ Outgoing

Contact Made By:

Name: Ahnna Westrich	**Title:** Staff Geologist	**Organization:** Camp, Dresser & McKee, Inc. (CDM)

Individual Contacted:

Name: Scott Seyfried	**Title:** Project Manager	**Organization:** Arcadis
Telephone No: (916) 786-0342 **Fax No:** **E-Mail Address:** scott.seyfried@arcadis-us.com	**Street Address:** **City, State, Zip:**	

Summary of Conversation

Mr. Seyfried stated that Levine Fricke/LFR/Arcadis have been the contractor for the Site since 1987 and that he has worked with the Site since that time. Mr. Seyfried indicated that there have not been any violations, incidents, or vandalism at the Site and there has been no community concern regarding the Site.

1. **Is the remedy functioning as expected? How well is the remedy performing?**
   - Based on review of the analytical data since 2005, Mr. Seyfried believes that the current Site remedy of monitored natural attenuation and institutional controls is working.
2. **What does the monitoring data show? Are there any trends that show contaminant levels are decreasing?**
   - Based on review of the analytical data since 2005, which was provided to CDM, Mr. Seyfried indicated that the VOC concentrations are decreasing and that the current Site remedy of monitored natural attenuation and institutional controls is working.
3. **Is there a continuous on-site O&M presence? If so, please describe staff and activities. If there is not a continuous on-site present, describe staff and frequency of site inspections and activities.**
   - Arcadis conducts Site semi-annual groundwater monitoring events. Other than these monitoring events, Arcadis does not make any routine Site visits.
4. **Have there been any significant changes in the O&M requirements, maintenance schedules, or sampling routines since start-up or in the last five years? If so, do they affect the protectiveness or effectiveness of the remedy? Please describe changes and impacts.**
   - LFR obtained approval from the EPA to abandon three groundwater monitoring wells (W-22, W-25, and LF-2) and three extraction wells (E-3, E-5, and E-7). These 6 wells were destroyed in July 2007. Destruction of these wells has had no impact on the protectiveness or effectiveness of the remedy.
5. **Have there been unexpected O&M difficulties or costs at the site since start-up or in the last five years? If so, please give detail.**
   - Mr. Seyfried indicated that he would provide CDM with the O&M costs for the Site activities since 2005. According to Mr. Roth, a project geologist with Arcadis, since 2005, the annual O&M costs for the Sola site were $14,500.
6. **Have there been opportunities to optimize O&M, or sampling efforts? Please describe changes and**

resultant or desired cost savings or improved efficiency.

- No.

7. **Do you have any comments suggestions or recommendations regarding the project?**

- No.

Appendix F

ARARs Review Technical Memorandum

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CDM

Memorandum

To: *Dante Rodriguez, USEPA*

From: *Ed Song, CDM*
Peggy Bloisa, CDM

Date: *May 21, 2010 (revised September 24, 2010)*

Subject: *Sola Optical USA Inc. Superfund Site, Petaluma, CA*
Third Five-Year Review Report 2010
ARAR Review Memorandum

For this five year review, Applicable or Relevant and Appropriate Requirements (ARARs) in the 2007 Record of Decision (ROD) Amendment (EPA 2007) were reviewed for any changes, additions, or deletions.

The 2007 ROD Amendment (EPA 2007) updated the ARARs to meet the recommendations from the previous Five Year Review. MCLs were reaffirmed as the applicable groundwater cleanup standards for the current remedy (monitored natural attenuation) and ARARs for institutional controls were adopted to ensure future protectiveness. A summary of chemical-specific ARARs is provided in Table 1. The current version of California Code of Regulations (CCR), Title 22 was reviewed to ensure all information is current. The MCLs for the two contaminants of concern, 1,1-DCA and 1,1-DCE have not changed. No ARARs were identified that are more stringent than the current clean-up levels for 1,1-DCA and 1,1-DCE. Review of on-site activities at the Sola Optical USA, Inc. Superfund Site (Site) since the previous Five Year Review (EPA 2005) indicate that there have been no changes in ARARs or standards affecting the protectiveness of the remedy since the changes adopted in the 2007 ROD Amendment. The selected institutional control (restrictive covenant) continues to prevent groundwater usage at the Site.

References

United States Environmental Protection Agency. 2005. *Second Five-Year Review Report for the Sola Optical USA, Inc. Superfund Site, Sonoma County, California.* September.

United States Environmental Protection Agency. 2007. *Record of Decision Amendment for the Sola Optical USA, Inc. Superfund Site, Petaluma, California.* March 30.

cc: Rachel Hess, ITSI

Table 1
Applicable or Relevant and Appropriate Requirements (ARARs)
Sola Optical Superfund Site
Petaluma, CA

Authority	Medium	Requirement	Status	Synopsis of Requirement
CHEMICAL-SPECIFIC CRITERIA				
Federal Regulatory Requirement	Groundwater	Federal Primary Drinking Water Standards 40 Code of Federal Regulations (CFR) Part 141 Safe Drinking Water Act 40 U.S.C §300	Relevant and Appropriate	Federal primary MCLs under the Safe Drinking Water Act (SDWA) protect the public from contaminants that may be found in drinking water. The onsite remedies mitigated potential or further degradation of ground water. Ongoing monitoring events are conducted to confirm compliance.
State Regulatory Requirement	Groundwater	California Primary Drinking Water Standards Health and Safety Code (H&S Code) §4010 et seq. 22 California Code of Regulations (CCR), Division 4, Chapter 15, §64431 and 64444	Relevant and Appropriate	California Primary MCLs protect public health from contaminants that may be found in drinking water sources and are at least as stringent as the federal standard. The onsite remedies mitigated potential or further degradation of ground water. Ongoing monitoring events are conducted to confirm compliance.
ACTION-SPECIFIC CRITERIA				
Federal and State Regulatory Requirement	Groundwater	Hazardous Waste Regulations 40 CFR §264.171-264.178 22 CCR §66262.34	Substantive provisions are applicable if waste is determined to be RCRA hazardous waste.	Onsite hazardous waste accumulation is allowed for up to 90 days as long as the waste is stored in containers or tanks, on drip pads, inside buildings, is labeled and dated, etc. May be applicable to spent carbon if it is determined to be a hazardous waste.
State Regulatory Requirement	Groundwater	California Code of Regulations, Title 22, section 67391.1 Civil Code Section 1471	Applicable	Establishes requirements for imposing covenant restrictions.

Appendix G

HHRA Review Technical Memorandum

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CDM

Memorandum

To: *Dante Rodriguez, USEPA*

From: *Kassandra Tzou, CDM*

Date: *June 2, 2010 (revised September 27, 2010)*

Subject: *Sola Optical USA Inc. Superfund Site, Petaluma, CA*
Third Five-Year Review Report 2010
Ecological and Human Health Risk Assessment and Toxicology Review Memorandum

The Ecological and Human Health Risk Assessment and Toxicology reviewed for the 2010 Five-Year Review report are those contained in the 2007 Record of Decision (ROD) Amendment (EPA, 2007).

In the 1991 ROD, the selected remedy (enhanced groundwater extraction system) was intended to reduce the present and future on-site risk to human health and the environment to a $1x10^{-4}$ (1 in 10,000) cancer risk for 1,1-DCE, and to restore the groundwater to full beneficial use, which for this site is drinking water. More specifically, the objectives for the remedial action at the Site were to clean-up the groundwater to state or federally promulgated drinking water standards (i.e., Federal and California maximum contaminant levels [MCLs]).

The groundwater extraction system operated from 1992 to 1997. In 1997, the groundwater extraction system was turned off and potential rebound was evaluated. After two years, the groundwater extraction system was decommissioned and 17 monitoring wells and 4 piezometers were destroyed. Based on the groundwater monitoring data during this time, Sola requested that the Environmental Protection Agency (EPA) consider monitored natural attenuation (MNA) as a final remedy (LFR, 2001). The 2007 ROD Amendment was signed on March 30, 2007 and modified the previously selected remedy for the Site (EPA, 2007). This amendment changes the site remedy to MNA, but retains MCLs as clean-up targets for groundwater.

Ecological Risk Review

Based on the Work Plan for the Five-Year Review, assessment of ecological risks was not needed to complete the review. As stated in the 2007 ROD amendment, the 1991 risk assessment included an ecological risk assessment that focused on possible impacts to nearby Adobe Creek, the closest surface water body to the Site. Based on data from groundwater

monitoring wells between the Sola facility and Adobe Creek, EPA determined that no contaminants were moving towards or had reached the creek. In addition, contaminant concentrations in the groundwater beneath the Sola facility were below federal surface water quality criteria for the protection of aquatic life. The assessment also noted that contaminated groundwater from the Sola facility could flow in the direction of Adobe Creek if the groundwater extraction system were shut off. Currently, the site remedy is to achieve MCLs in groundwater through MNA. The extraction system has been eliminated and groundwater flow toward the creek could resume. However, since groundwater concentrations were below water quality criteria in 1991 and have been reduced since then, discharge of water to Adobe Creek would not have any impact on aquatic life in the creek.

During the Site inspection for this Five-Year Review, the Site environmental setting appears to have changed since the 2007 ROD amendment, with construction of an asphalt parking lot and four building pads with associated below grade infrastructure (i.e., electrical and plumbing) on the auxiliary 11 acre parcel. This development does not appear to provide habitat that would be attractive to ecological receptors. No new ecological receptors were noted during the Site inspection. No additional assessment for ecological risks was conducted for the five year review.

Human Health Risk Review

The risk assessment prepared in 1991 and discussed in the 1991 ROD evaluated the Site for hypothetical future residential use even though the Site is used for light industrial / commercial purposes and is not planned for residential use. Hypothetical residents were evaluated for ingestion of contaminated groundwater and inhalation of contaminants in indoor air via vapor intrusion. The risk assessment concluded that there would not be any non-carcinogenic health effects through either of these exposure pathways. Carcinogenic risks for vapor intrusion would be 9×10^{-6} and for ingestion of contaminated groundwater would be 1×10^{-4} (EPA, 1991). Since shallow groundwater at the site could in theory be used as a drinking water source, risk management for the site included a remedy based on achieving drinking water standards. Groundwater cleanup standards established for the Site were California MCLs.

For the 2005 Five-Year Review, additional risk evaluations were conducted to assess a homegrown produce pathway for potential future residents and an indoor air pathway for on-site workers and potential future residents. These pathways were shown to not pose an increased health risk. The literature review indicated that uptake and accumulation of volatile organic compounds (VOCs) in plants and subsequent exposure by home gardeners and their families are likely to be low. For the vapor intrusion assessment, Site VOC concentrations were compared to both target and screening levels (MCLs, Water Board Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns, and the groundwater environmental screening levels [ESLs]), and were found to be well below the criteria. Therefore, it was concluded that the vapor intrusion pathway is not of concern at this Site (EPA, 2005a).

For this 2010 Five-Year Review, target and screening levels considered in the 2005 Five-Year Review were updated to determine if the focus on MCLs as the Site groundwater cleanup standards remains appropriate. Table 1 shows Site groundwater contaminant concentrations and their respective MCLs, target groundwater concentrations and groundwater ESLs. California MCLs presented in this table are the same as during MCLs used in the 2005 Five-Year Review, except for Freon 113 (which could be a unit conversion error in the 2005 table). Further, EPA has not updated its 2002 Subsurface Vapor Intrusion Guidance document (EPA 2002). However, the San Francisco Regional Water Quality Control Board (Water Board) updated ESLs for vapor intrusion in 2008 (Water Board, 2008). These updated values are presented in the table.

Site groundwater concentrations from 2005 to 2010 are still well below both target and updated VI screening levels (Table 1). Concentrations of 1,1-dichloroethane (1,1-DCA) range from 6.5 to 16 micrograms per liter (μg/L); these concentrations still exceed the CDHS Primary MCL of
5 μg/L.

Table 1
Groundwater Concentrations, MCLs, Target Groundwater Concentrations, And Groundwater ESLs for Vapor Intrusion Into Indoor Air
Sola Optical USA, Inc. Third Five-Year Review Report
Sonoma County, CA

Chemicals Detected in Groundwater at Sola Optical Superfund Site	Range of Site Concentrations Detected October 2005 to December 2009 (μg/L)	CDPH[a] Primary MCL (μg/L)	Target Groundwater Concentration (μg/L)[b]	Water Board Groundwater Screening Levels (μg/L)[c]
1,1,1-Trichloroethane	ND	200	3,100	130,000 – 360,000
1,1-Dichloroethylene	0.8 – 5.6	6	190	6,300 – 18,000
1,1-Dichloroethane	6.5 – 16	5	2,200	1,000 – 3,400
Methylene chloride	ND	5	5,800	2,400 – 8,100
1,2-Dichloroethane	ND	0.5	230	200 – 690
Trichloroethylene	ND	5	5.3	530 – 1,800
Freon 113	ND	1,200	1,500	NA

Notes:
a) CDPH = California Department of Public Health, Table updated April 14, 2010 (CDPH, 2010).
b) EPA Office of Solid Waste and Emergency Response (OSWER), 2002. Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance). November 2002 (EPA OSWER, 2002). Target Groundwater Concentration to Target Indoor Air Concentration Where the Soil Gas to Indoor Air Attenuation Factor = 0.001 and Partitioning Across the Water Table Obeys Henry's Law C_{gw} for cancer risk = 10^{-4} and hazard index = 1.
c) California Regional Water Quality Control Board San Francisco Region, 2008. Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater – Interim Final. Table E-1. Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns. November 2007, updated May 2008 (Water Board, 2008). (Range of concentrations shown represent residential to industrial exposure scenarios, high permeability soils assumed).

Toxicity criteria for 1,1-dichloroethylene (1,1-DCE) and 1,1-DCA were also reviewed for this Five-Year Review. EPA's online Integrated Risk Information System (EPA, 2010) indicates that these criteria have not been revised since 2002 and 1990, respectively. The California EPA Office of Environmental Health Hazard Assessment (OEHHA) online toxicity database indicates that toxicity criteria for 1,1-DCA were last reviewed in 2009, however these values have not changed since 1992 (CalEPA 1992; 2009, 2010). OEHHA does not list toxicity criteria for
1,1-DCE.

Although the EPA has not updated its vapor intrusion guidance document, the California Department of Toxic Substance Control (DTSC) issued its own vapor intrusion guidance (*Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air*) in 2004 and updated this guidance in February 2005. This document does not provide generic groundwater screening levels, however, it does provide a conservative mathematical model (Johnson and Ettinger Excel spreadsheet model) for calculating cancer risks and non-cancer hazards from inhalation of vapors migrating from groundwater to. These models have been adjusted by DTSC (GW-Screen Version 3.0 April 2003, last modified by DTSC on February 4, 2009) with California toxicity criteria and default parameters assuming a residential receptor. When the maximum Site groundwater concentrations of 1,1-DCE and 1,1-DCA detected from 2005 to 2010 are entered into the DTSC-adjusted Johnson and Ettinger model using default parameters and assuming a sand vadose zone, the cancer risk for 1,1-DCA is 9×10^{-7}, which is below the EPA risk management range of 10^{-6} to 10^{-4}. The hazard quotients for 1,1-DCE (0.04) and 1,1-DCA (0.002) are also well below the target threshold of one. The model printouts for these two chemicals are provided in Attachment A. Note that the above calculations are not site-specific. Instead, they use conservative default input parameters to provide a screening level evaluation of the potential for vapor intrusion. The Johnson and Ettinger models were not used in the previous risk assessment or the 2005 Five-Year Review.

Recent developments in human health risk analysis recommend consideration of two residential exposure issues that were not evaluated in previous risk analyses for the Site – breastfeeding and early-life exposure to carcinogens. The breastfeeding pathway is commonly a pathway of concern for bioaccumulating chemicals such as polychlorinated biphenyls (PCBs), which are not contaminants of concern at the Site. Similarly, the list of chemicals identified by the EPA as having carcinogenic effects from early life exposure does not include the contaminants of concern at the Site (EPA, 2005b). These are emerging issues in the field of risk assessment are not expected to affect risk management decisions made at the Site based on the previous 1991 and 2005 risk analyses. Finally, OEHHA has published a few chronic reference doses specifically for children; however, the list is small and does not include the primary contaminants of concern at the Site.

In addition, as mentioned above, the Site is currently used for light industrial / commercial purposes and is not planned for residential use. Vapor intrusion is therefore not likely to be an issue for residents between now and the time when MCLs are reached. Further, use of shallow groundwater for drinking water also seems unlikely in the foreseeable future and no ingestion exposures to chemicals of concern in groundwater are expected..

Therefore, exposure assumptions, toxicity data, clean-up levels, and remedial action objectives for selection of MNA and use of California MCLs in the 2007 ROD Amendment remain valid.

References

California Department of Public Health. 2010. *Table of MCLs, DLRs, and PHGs for Regulated Drinking Water Contaminants*. last updated April 14, 2010.

California Department of Toxic Substance Control (DTSC). 2005. *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air.* 2004, updated February 2005.

California Environmental Protection Agency (CalEPA) Office of Environmental Health Hazard Assessment (OEHHA). 1992. *Expedited Cancer Potency Values and Proposed Regulatory Levels for Certain Proposition 65 Carcinogens.* April.

_____. 2009. *Technical Support Document for Cancer Potency Factors: Methodologies for derivation, listing of available values, and adjustments to allow for early life stage exposures.* May.

_____. 2010. Online Toxicity Database - http://www.oehha.ca.gov/risk/ChemicalDB/index.asp, accessed May 10, 2010.

California Regional Water Quality Control Board San Francisco Region (Water Board), 2008. *Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater – Interim Final.* November 2007, updated May 2008.

Levine Fricke (LFR). 2001. *Evaluation of Monitored Natural Attenuation as a Remedy to Meet Remedial Action Objectives; Sola Optical USA, Inc.*, Site. April 4.

United States Environmental Protection Agency (EPA). 1991. *Record of Decision; Sola Optical Site*. September 27.

_____. Office of Solid Waste and Emergency Response (OSWER). 2002. *Draft Guidance for Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils (Subsurface Vapor Intrusion Guidance).* November.

_____. 2005a. *Second Five-Year Review Report for the Sola Optical USA, Inc. Superfund Site, Sonoma County, California.* September.

_____. 2005b. *Supplemental Guidance for Assessing Susceptibility from Early-Life Exposure to Carcinogens.* March.

_____. 2007. *Record of Decision Amendment for the Sola Optical USA, Inc. Superfund Site, Petaluma, California.* March 30.

_____. 2010. Online Integrated Risk Information System (IRIS) - http://www.epa.gov/iris/, accessed May 10, 2010.

Attachments

Attachment A Johnson and Ettinger Model Output for 1,1-DCE and 1,1-DCA

cc: Rachel Hess, ITSI

Attachment A

Johnson and Ettinger Model Output for 1,1-DCE and 1,1-DCA

1,1-Dichloroethene (1,1-DCE)

DATA ENTRY SHEET

GW-SCREEN
Version 3.0; 04/03

Reset to Defaults

CALCULATE RISK-BASED GROUNDWATER CONCENTRATION (enter "X" in "YES" box)

YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES X

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 2/4/09)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75354	5.60E+00	1,1-Dichloroethylene

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	400	S	24	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
	OR	1.00E-08	S	1.66	0.375	0.054

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
9.00E-02	1.04E-05	2.60E-02	25	6,247	304.75	576.05	5.89E+01	2.25E+03	0.0E+00	7.0E-02

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
385	0.321	#N/A	#N/A	#N/A	1.00E-08	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	6,299	2.51E-02	1.03E+00	1.80E-04	1.45E-02	5.77E-04	7.02E-03

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
385	15	5.77E+03	1.25	8.33E+01	1.45E-02	5.00E+03	9.44E+04	4.42E-04	2.55E+00	NA	7.0E-02

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	2.25E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
NA	3.5E-02

MESSAGE SUMMARY BELOW:

END

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1,1-Dichloroethane (1,1-DCA)

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Version 3.0; 04/03

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YES

OR

CALCULATE INCREMENTAL RISKS FROM ACTUAL GROUNDWATER CONCENTRATION (enter "X" in "YES" box and initial groundwater conc. below)

YES X

DTSC
Vapor Intrusion Guidance
Interim Final 12/04
(last modified 2/4/09)

ENTER Chemical CAS No. (numbers only, no dashes)	ENTER Initial groundwater conc., C_W (µg/L)	Chemical
75343	1.60E+01	1,1-Dichloroethane

MORE ↓

ENTER Depth below grade to bottom of enclosed space floor, L_F (cm)	ENTER Depth below grade to water table, L_{WT} (cm)	ENTER SCS soil type directly above water table	ENTER Average soil/ groundwater temperature, T_S (°C)	ENTER Average vapor flow rate into bldg. (Leave blank to calculate) Q_{soil} (L/m)
15	400	S	24	5

MORE ↓

ENTER Vadose zone SCS soil type (used to estimate soil vapor permeability)		ENTER User-defined vandose zone soil vapor permeability, k_v (cm^2)	ENTER Vadose zone SCS soil type (Lookup Soil Parameters)	ENTER Vadose zone soil dry bulk density, ρ_b^V (g/cm^3)	ENTER Vadose zone soil total porosity, n^V (unitless)	ENTER Vadose zone soil water-filled porosity, θ_w^V (cm^3/cm^3)
	OR	1.00E-08	S	1.66	0.375	0.054

MORE ↓

ENTER Target risk for carcinogens, TR (unitless)	ENTER Target hazard quotient for noncarcinogens, THQ (unitless)	ENTER Averaging time for carcinogens, AT_C (yrs)	ENTER Averaging time for noncarcinogens, AT_{NC} (yrs)	ENTER Exposure duration, ED (yrs)	ENTER Exposure frequency, EF (days/yr)
1.0E-06	1	70	30	30	350

Used to calculate risk-based groundwater concentration.

CHEMICAL PROPERTIES SHEET

ABC

Diffusivity in air, D_a (cm^2/s)	Diffusivity in water, D_w (cm^2/s)	Henry's law constant at reference temperature, H ($atm\text{-}m^3/mol$)	Henry's law constant reference temperature, T_R (^oC)	Enthalpy of vaporization at the normal boiling point, $\Delta H_{v,b}$ (cal/mol)	Normal boiling point, T_B (^oK)	Critical temperature, T_C (^oK)	Organic carbon partition coefficient, K_{oc} (cm^3/g)	Pure component water solubility, S (mg/L)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
7.42E-02	1.05E-05	5.61E-03	25	6,895	330.55	523.00	3.16E+01	5.06E+03	1.6E-06	7.0E-01

END

INTERMEDIATE CALCULATIONS SHEET

Source-building separation, L_T (cm)	Vadose zone soil air-filled porosity, θ_a^V (cm^3/cm^3)	Vadose zone effective total fluid saturation, S_{te} (cm^3/cm^3)	Vadose zone soil intrinsic permeability, k_i (cm^2)	Vadose zone soil relative air permeability, k_{rg} (cm^2)	Vadose zone soil effective vapor permeability, k_v (cm^2)	Thickness of capillary zone, L_{cz} (cm)	Total porosity in capillary zone, n_{cz} (cm^3/cm^3)	Air-filled porosity in capillary zone, $\theta_{a,cz}$ (cm^3/cm^3)	Water-filled porosity in capillary zone, $\theta_{w,cz}$ (cm^3/cm^3)	Floor-wall seam perimeter, X_{crack} (cm)
385	0.321	#N/A	#N/A	#N/A	1.00E-08	17.05	0.375	0.122	0.253	4,000

Bldg. ventilation rate, $Q_{building}$ (cm^3/s)	Area of enclosed space below grade, A_B (cm^2)	Crack-to-total area ratio, η (unitless)	Crack depth below grade, Z_{crack} (cm)	Enthalpy of vaporization at ave. groundwater temperature, $\Delta H_{v,TS}$ (cal/mol)	Henry's law constant at ave. groundwater temperature, H_{TS} (atm-m^3/mol)	Henry's law constant at ave. groundwater temperature, H'_{TS} (unitless)	Vapor viscosity at ave. soil temperature, μ_{TS} (g/cm-s)	Vadose zone effective diffusion coefficient, D^{eff}_V (cm^2/s)	Capillary zone effective diffusion coefficient, D^{eff}_{cz} (cm^2/s)	Total overall effective diffusion coefficient, D^{eff}_T (cm^2/s)
3.39E+04	1.00E+06	5.00E-03	15	7,294	5.38E-03	2.21E-01	1.80E-04	1.20E-02	4.79E-04	5.81E-03

Diffusion path length, L_d (cm)	Convection path length, L_p (cm)	Source vapor conc., C_{source} ($\mu g/m^3$)	Crack radius, r_{crack} (cm)	Average vapor flow rate into bldg., Q_{soil} (cm^3/s)	Crack effective diffusion coefficient, D^{crack} (cm^2/s)	Area of crack, A_{crack} (cm^2)	Exponent of equivalent foundation Peclet number, $\exp(Pe^f)$ (unitless)	Infinite source indoor attenuation coefficient, α (unitless)	Infinite source bldg. conc., $C_{building}$ ($\mu g/m^3$)	Unit risk factor, URF $(\mu g/m^3)^{-1}$	Reference conc., RfC (mg/m^3)
385	15	3.53E+03	1.25	8.33E+01	1.20E-02	5.00E+03	1.08E+06	3.77E-04	1.33E+00	1.6E-06	7.0E-01

RESULTS SHEET

RISK-BASED GROUNDWATER CONCENTRATION CALCULATIONS:

Indoor exposure groundwater conc., carcinogen (μg/L)	Indoor exposure groundwater conc., noncarcinogen (μg/L)	Risk-based indoor exposure groundwater conc., (μg/L)	Pure component water solubility, S (μg/L)	Final indoor exposure groundwater conc., (μg/L)
NA	NA	NA	5.06E+06	NA

INCREMENTAL RISK CALCULATIONS:

Incremental risk from vapor intrusion to indoor air, carcinogen (unitless)	Hazard quotient from vapor intrusion to indoor air, noncarcinogen (unitless)
8.7E-07	1.8E-03

MESSAGE SUMMARY BELOW:

END

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