Statement of Basis
for
Proposed Soil and Ground Water Remedy

Romic Environmental Technologies Corporation
East Palo Alto, California

U.S. Environmental Protection Agency
Region 9

September 14, 2007

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for
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Prepared by U.S. Environmental Protection Agency, Region 9
San Francisco, California

September 14, 2007

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Statement of Basis for Remedy Selection at Romic Environmental Technologies Corporation Facility, East Palo Alto, California

1. Executive Summary

The U.S. Environmental Protection Agency ("U.S. EPA") is requesting public comment on a proposed remedy to address soil and ground water contamination at the Romic Environmental Technologies Corporation facility ("Facility or Romic facility") in East Palo Alto, California. This Statement of Basis ("SB") presents the U.S. EPA's proposed remedy for the Romic facility. It contains a summary of background information, investigation findings, exposure information, remedial alternatives and the proposed remedy.

Contaminated sediments in the slough adjacent to Romic's eastern boundary are not addressed in this remedy decision but will be covered in a later action. U.S. EPA is having discussions with the wildlife trustee agencies regarding the contaminated sediments in the slough. These discussions could result in additional ecological studies being conducted at the slough. In order to expedite the on-site cleanup process at the Facility, contaminated sediments in the slough are not addressed in this remedy decision but will be covered in a later action.

The Romic facility stopped accepting waste on August 3, 2007. Romic representatives have indicated that they will begin the process of closing the East Palo Alto facility in 2007. Regulatory oversight of facility closure is the responsibility of the California Environmental Protection Agency, Department of Toxic Substances Control ("DTSC"). U.S. EPA and DTSC will coordinate plans for soil and ground water remediation with Romic's closure.

Romic is a 14-acre hazardous waste management facility located in East Palo Alto, California. Facility operations have included solvent recycling, fuel blending, wastewater treatment, and hazardous waste storage and treatment. Due to historical waste management practices dating back to the mid 1950's, soil and ground water at the Facility are contaminated with hazardous constituents. The primary contaminants in the soil and ground water are volatile organic compounds (VOCs). Typical VOCs include dry cleaning chemicals, carburetor cleaning liquids, paint thinners, and chemicals used to manufacture computers. .

Ground water contamination extends across most of the Facility to a depth of at least 80 feet below ground surface. Ground water at the site flows east toward San Francisco Bay. Ground water at the Romic facility is not a drinking water source.

The proposed remedy includes ground water and soil investigation and remediation; ground water and surface water monitoring; financial assurance (funding) for construction, operation, monitoring and maintenance of the ground water and soil remediation system; land use restrictions with a risk management plan; and five-year remedy performance evaluation reports. The remedy also entails investigation of currently inaccessible areas located below operational units of the Facility (including Solid Waste Management Units described in Section 5.3) and progress reports. The elements of the proposed remedy are described in Section 4, Proposed Remedy for Soil and Ground Water Contamination, of this SB.

The proposed remedial approach to clean up contamination at the Romic facility uses enhanced biological treatment, monitored natural attenuation, excavation and removal of contaminated soils, and maintenance of the existing site cover. Enhanced biological treatment involves injecting cheese whey and molasses into the solvent-contaminated soil and ground water. The cheese whey and molasses act as a food source for natural microbes that live in the subsurface. These microbes breakdown the solvents into carbon dioxide, water and salt. Romic has tested the effectiveness of this approach at the Facility and demonstrated that it works well in reducing contaminant concentrations. Romic is currently using biological treatment to remediate contaminated soil and ground water at several locations throughout the Facility as part of a U.S. EPA approved interim remedial measure. Expansion of the interim remedial measure, using enhanced biological treatment, is the proposed remedial technology to address contamination at the Facility.

The proposed remedy requires restrictions on future land use be imposed through a “Covenant to Restrict Use of Property”, which is an enforceable institutional control mechanism. A key requirement being proposed is that the property use be restricted to commercial and industrial purposes.

U.S. EPA is proposing one media cleanup objective for ground water, one objective for surface water and one objective for indoor air vapor intrusion for future redevelopment. Maximum Contaminant Levels for drinking water are proposed as the site-wide cleanup objective for all ground water at the Facility. The Surface Water Estuarine Screening Levels, developed by the California Regional Water Quality Control Board, San Francisco Bay Region, is the proposed media cleanup objective for surface water in the sloughs near the Romic facility. The estuarine screening levels generally represent the most stringent of available action levels for aquatic habitat protection. Any future redevelopment of the Facility property will need to meet U.S. EPA's risk-based concentrations for vapor intrusion in any existing structures that remain in place or new structures built on the Facility property as part of a redevelopment project. The proposed cleanup objectives are further described in Section 10, Media Cleanup Objectives, of this SB.

U.S. EPA has concluded, based on all the information available to date and an evaluation of other remedial alternatives, that the proposed remedy is protective of human health and the environment. The proposed remedy has the best chance of attaining the cleanup objectives, remediating source areas and limiting off-site migration of volatile organic compounds from the source areas. Further, the proposed remedy will limit the potential for vapor intrusion into structures. Although residual contamination may remain in soil and ground water, U.S. EPA believes that the proposed remedy is still protective of human health and the environment.

U.S. EPA will select a final remedy for the Romic facility after considering public comments. A 45-day public comment period will begin on September 17, 2007 and end on November 1, 2007. Comments may be submitted to U.S. EPA during the public comment period in writing via mail, email, or in person at a public meeting/hearing on the proposed remedy. The public meeting/hearing will be held on Wednesday, October 10, from 6:00 to 9:00 pm at the East Palo Alto City Hall located at 2415 University Avenue, (First Floor - City Council Chambers and Community Room), East Palo Alto, California 94303. Spanish translation will be available at the meeting and hearing.

Comments may be faxed (fax number 415-947-3530) or mailed to: Ronald Leach, Project Manager (WST-5), U.S. Environmental Protection Agency, 75 Hawthorne Street, San Francisco, CA 94105 or sent via electronic mail to leach.ronald@epa.gov.

2. Introduction

This SB explains and justifies U.S. EPA=s proposed remedy to address soil and ground water contamination at the Romic facility. It contains a summary of background information, investigation findings, exposure information, remedial alternatives and the proposed remedy.

The U.S. EPA is proposing this remedy under the authority of the Resource Conservation and Recovery Act ("RCRA"), as amended by the Hazardous and Solid Waste Amendment of 1984. In 1988, Romic entered into a RCRA 3008(h) Administrative Order on Consent ("Consent Order") with U.S. EPA that required Romic to perform a RCRA Facility Investigation (RFI), develop a Corrective Measures Study (CMS) to evaluate remedial options, and implement a remedy selected by U.S. EPA to correct past releases to the environment from the Facility.

This SB is organized into the following sections: Section 1. Executive Summary, Section 2, Introduction, Section 3. Public Participation for Remedy Selection, Section 4. Proposed Remedy for Soil and Ground Water Contamination, Section 5. Facility Background, Section 6. Environmental Setting, Section 7. Extent of Contamination, Section 8. Exposure Assessment for Human Health and Ecological Receptors, Section 9. Interim Remedial Measures, Section 10. Media Cleanup Objectives, Section 11. Remedial Technologies Evaluation, Section 12. Development of Corrective Action Remedial Alternatives, Section 13. Evaluation of Corrective Action Remedial Alternatives/Recommended Alternative and Section 14. Reference Documents.

3. Public Participation for Remedy Selection

U.S. EPA is requesting comments on the proposed remedy to address soil and ground water contamination at the Romic facility.

U.S. EPA has issued a public notice and fact sheet announcing a 45-day comment period. The public comment period will begin on September 17, 2007 and end on November 1, 2007. Comments may be submitted to U.S. EPA during the public comment period in writing via mail, email, fax or in person at a public meeting/hearing on the proposed remedy. The public meeting/hearing will be held on Wednesday, October 10, from 6:00 to 9:00 pm at the East Palo Alto City Hall located at 2415 University Avenue (First Floor - City Council Chambers and Community Room), East Palo Alto, California 94303. Spanish translation will be available at the meeting and hearing.

Written comments should be faxed or postmarked on or before November 1, 2007 and sent to:

Ronald Leach, Project Manager (WST-5)
US Environmental Protection Agency
75 Hawthorne Street
San Francisco, CA 94105

Telephone Number: (415) 972-3362.
Fax Number: (415) 947-3530

Comments may also be sent via electronic mail to leach.ronald@epa.gov

U.S. EPA will consider the public comments it receives together with other relevant information in making the remedy decision for the Facility. In selecting the final remedy, U.S. EPA may modify the proposed remedy based on relevant public comments, new information, and further U.S. EPA deliberation. U.S. EPA will respond to all the relevant comments it receives on the proposed remedy. Anyone who comments on the proposal will receive notice of the final remedy decision.

The administrative record contains all of the documents, correspondence, data, and other information U.S. EPA considered in proposing the remedy for the Romic facility. The reference documents, which U.S. EPA used to prepare this SB, are listed in Section 14.

The reference documents along with a list of all items in the administrative record are available for public review at the East Palo Alto Public Library located at at 2415 University Avenue, East Palo Alto, California 94303. Hard copies of the full administrative record are available for public review at the U.S. EPA office, located at 75 Hawthorne Street, San Francisco, California 94105.

4. Proposed Remedy for Soil and Ground Water Contamination

The proposed remedy includes ground water and soil remediation; ground water and surface water monitoring; financial assurance for construction, operation, monitoring and maintenance of the ground water and soil remediation system; land use restrictions with a risk management plan; five-year remedy performance evaluation reports; investigation of currently inaccessible areas (e.g., process plant, former drum storage areas); and progress reports.

Romic representatives have indicated that in 2007 they will begin the process of shutting down operations and closing the East Palo Alto facility. Closure of the Facility deals with the aboveground units (e.g., tanks, pipes, buildings) and the U.S. EPA proposed remedy addresses the subsurface soil and ground water contamination. DTSC will oversee the regulatory process of closing the Facility. U.S. EPA and DTSC will coordinate the closure of the Facility with the remediation of soil and ground water contamination.

The ground water and soil remediation is divided into two phases in order to address contamination in currently inaccessible areas. Some of the contaminated areas of the Facility are not currently accessible for remediation because they are located under existing buildings and/or process units. Once these buildings and/or process units are removed during the closure process, investigation and remediation of the currently inaccessible areas can begin. Each of the proposed remedy elements are described below along with contingency requirements.

4.1 Proposed Remedy

Soil and Ground Water Remediation - The proposed remedy to address soil and ground water contamination involves the use of enhanced biological treatment, monitored natural attenuation, and excavation and removal of contaminated soils. In addition, Romic will continue to maintain the existing site cover or cap.

Romic tested the enhanced biological treatment approach in the field and demonstrated its effectiveness at reducing contaminant concentrations in ground water. With U.S. EPA's approval, Romic has expanded the test locations and is currently using biological treatment at several areas at the Facility. The enhanced biological treatment approach involves injecting cheese whey and molasses into the solvent contaminated soil and ground water. Cheese whey is the watery part of milk that is separated from the curd in the process of making cheese. The cheese whey and molasses act as a food source for natural microbes that live in the subsurface. These microbes breakdown the solvents, cheese whey, and molasses into carbon dioxide, water and salt. All soils at the Facility below a depth of about 3 to 8 feet are saturated with water. Since saturated soils and ground water are closely linked, any remediation of the ground water will also benefit the saturated soils.

Enhanced biological treatment will be used together with monitored natural attenuation (MNA) to remediate the soil and ground water. Enhanced biological treatment will first be used to significantly reduce contaminant concentrations and be followed-up with the MNA until the media cleanup objectives are achieved. MNA allows natural processes to reduce contamination in soil and ground water. These processes include biodegradation, dispersion, dilution, sorption, and volatilization. Implementation of monitored natural attenuation typically involves continued monitoring of contaminant concentrations to quantify attenuation rates and progress toward meeting the media cleanup objectives. At some point, active remediation will cease and the concentrations of contaminants in ground water will be allowed to attenuate naturally to eventually achieve the media cleanup objectives for restoration of ground water quality. U.S. EPA or the lead state agency overseeing remedy implementation will determine the appropriate time when active remediation will cease at Romic and when monitored natural attenuation will be used at the Facility.

Soil excavation and removal will be directed to areas of the Facility where it is more practical to remove rather than treat the contaminated soils. However, some of these areas may not be available for possible excavation until during or after the Facility closes. The size of the areas to be excavated will be determined after the currently inaccessible areas are investigated.

The proposed remedy requires that the existing concrete-asphalt cap be maintained to prevent direct contact with any contaminated soils. If in the future, removal of any cover material becomes necessary to facilitate closure of the Facility, fresh asphalt-concrete will be installed in the affected area if needed.

Most contaminated soils (source areas) are not accessible to investigation and remediation because they are covered by operational areas of the Facility such as buildings, tanks, and the process plant. Therefore, the proposed remedy involves conducting soil and ground water remediation in two phases, sequenced to allow for access to contaminated media. Phase 1 involves remediation at contaminated areas that are currently accessible and will primarily occur while the Facility is in commercial operation. Some of the Phase 1 work could extend into Facility Closure and post-closure periods (e.g., continued biological treatment). Phase 2 entails remediation of currently inaccessible areas expected to become available after the Facility closes. The majority of Phase 2 remedial work would likely begin at Facility Closure and extend into the post-closure period. Thus, there would be both Phase 1 and Phase 2 corrective action remedial work underway after the Facility closes. The Facility closure plan specifies how the Facility will be closed when Romic ceases operations. As discussed above, regulatory oversight of Facility Closure is the responsibility of DTSC.

Ground Water and Surface Water Monitoring - Romic currently has a U.S. EPA-approved ground water and surface water monitoring plan. Surface water in the adjacent slough and approximately 40 on-site monitoring wells are sampled on a periodic basis (once, twice or four times per year). This plan will be revised to ensure consistency with the soil and ground water remedy.

Financial Assurance - Financial assurance is proposed for monitoring, construction, and operation and maintenance of the selected remedy (Phase 1 and Phase 2). Romic has set aside money to assure that the required remediation work will be completed now and into the future. In June 2007 Romic established an interim financial assurance mechanism for remediation of the Facility. This mechanism is a surety bond for $1.5 Million U.S. dollars. After selection of the final remedy, the funding level for the financial assurance mechanism will be adjusted to reflect the cost estimate for the selected remedy.

Land Use Restrictions - In light of the extent of soil and ground water contamination at the Romic facility, the proposed remedy requires that certain restrictions be imposed on future land use activities. The proposed restrictions are necessary to protect human health and the environment, and to maintain the short and long term protectiveness of the remedy. The restrictions will be imposed through a "Covenant to Restrict Use of Property" ("Covenant") which is an enforceable institutional control mechanism. The Covenant restrictions "run with the land" and apply no matter who owns the property. The land use restrictions may, with regulatory agency approval, be revised if site conditions should change in the future (e.g, new land use).

The specific language for the Romic Covenant will be developed after U.S. EPA selects the final remedy. U.S. EPA is proposing the following land use restrictions be included in the Covenant:

- Use of the property is restricted to commercial and industrial purposes only.

- The property shall not be used for any of the following purposes:

  - A residence for human habitation, including any mobile home or factory-built housing

- A hospital or hospice for humans
- A public or private school for persons under 21 years of age
- A day care center for children or day care center for Senior Citizens

● The following activities shall not be conducted at the property:

- Animal husbandry

- Growing food crops or any agricultural products

- Drilling for drinking water, oil or gas

- Extraction of ground water for purposes other than ground water monitoring, site remediation or construction dewatering

- Any activity that may disturb or adversely affect the operation and maintenance of the ground water monitoring network and site remediation system that is not part of a U.S. EPA or California EPA, Department of Toxic Substances Control ("DTSC") approved corrective action workplan or facility closure plan for the property without written approval from U.S. EPA or DTSC.

- Any activity that may disturb or adversely affect the integrity of the paved/concrete facility cover that is not part of a U.S. EPA or DTSC approved corrective action workplan or facility closure plan for the property without written approval from U.S. EPA or DTSC.

- Any redevelopment of the property until a Risk Management Plan (RMP) is prepared for the specific project and is approved in writing by U.S. EPA or DTSC. A RMP identifies, at a minimum, the specific project proposed for construction, the previous site history, the nature and extent of contamination from all media, the potential pathways of receptor exposure and health impacts from existing site contamination, and practical ways to mitigate the impacts for the specific project. The Covenant and the RMP work together to ensure that potential impacts from exposure to contaminated soils, ground water or other media are managed in a manner that is protective of human health and the environment. The RMP may be revised or amended. Any RMP or amended RMP approved in writing by U.S. EPA or DTSC is incorporated by reference into this Covenant and supersedes any existing RMP.

● The following risk management activities are required for the property:

- Any activities that will disturb the soil or ground water, such as excavation, grading, removal, trenching, filling, earth moving or mining, shall only be permitted on the property pursuant to a corrective action work plan or facility closure plan approved in writing by U.S. EPA or DTSC, or an RMP approved in writing by U.S. EPA or DTSC.

- Any contaminated media brought to the surface by grading, excavation, trenching, or backfilling shall be managed in accordance with all applicable provisions of state and federal laws.

Five Year Remedy Performance Evaluation Reports - The purpose of these reports is to provide an evaluation of the long-term effectiveness and reliability of the remedy including enhanced biological treatment and MNA with recommendations for improvement. The report examines such questions as: Are the media cleanup objectives and remedy performance standards being achieved? How well are things working? Are contaminant concentrations levels trending downward? What improvements are necessary and how will they be implemented?

Investigation of Currently Inaccessible Areas - Areas at the Facility that are currently inaccessible will be investigated when they become available either during or after Facility Closure. Currently inaccessible areas that will be investigated in the future include, among others, the former pond areas, central processing area, former drum storage areas, administration/laboratory building septic tank and drainfield, and other areas as appropriate such as the Solid Waste Management Units discussed in Section 5.3 of this SB. Based on the investigation findings, applicable remediation efforts will be directed to these areas (e.g., soil excavation, enhanced biological treatment).

Progress Reports - Progress reports are being required to update U.S. EPA, the community and other regulatory agencies on the status of the investigation and remediation activities at the Facility. The number of progress reports will probably vary between 2 to 4 per year. U.S. EPA will determine the frequency of progress reporting based on site specific conditions.

4.2 Remedy Contingencies

The proposed remedy contains the following contingencies:

Demonstration of System Performance: Romic will hydraulically and chemically monitor the performance of the remediation system. If monitoring data indicates that the system is not meeting the five remedy performance standards as described in Section 13 of this SB, modifications to the remedy will be required. Such modifications include, but are not limited to, the following: installation of additional injection or monitoring wells, modifications to the injection technology, or modifications to the well design.

Excavation and Removal of Contaminated Soil: The proposed remedy includes excavation and removal of approximately 3072 cubic yards of contaminated soils from the Facility. However, several areas at the site are currently inaccessible and will be investigated following Closure of the Facility. In addition, not all currently accessible areas at the Facility have been fully investigated. The size of the excavation will be determined based on investigation results. U.S.

EPA reserves the right (for itself or California regulatory agencies overseeing implementation of the selected remedy) to require excavation and removal as necessary to meet the remedy performance standards described in Section 13 of this SB. Alternatively, Romic may petition U.S. EPA or applicable California regulatory agencies overseeing remedy implementation for permission to excavate and remove contaminated soils as necessary to meet the remedy performance standards described in Section 13 of this SB. U.S. EPA or the applicable California regulatory agencies will evaluate and decide whether to approve Romic's petition at that time.

Treatment of Excavated Soil: After excavation, any contaminated soil shall be managed in accordance with all applicable provisions of state and federal laws.

Other New Information that Changes Current Conditions: If new information becomes available, or significant environmental changes occur on or off-site, additional remedial measures may be required. U.S. EPA reserves the right (for itself or California regulatory agencies overseeing implementation of the selected remedy) to modify the soil and ground water remedy as necessary to ensure that the remedy performance standards (including media cleanup objectives) are met. If significant changes to the selected remedy are necessary, these will be required through modification of the Remedy Decision.

5. Facility Background

5.1 Site Description

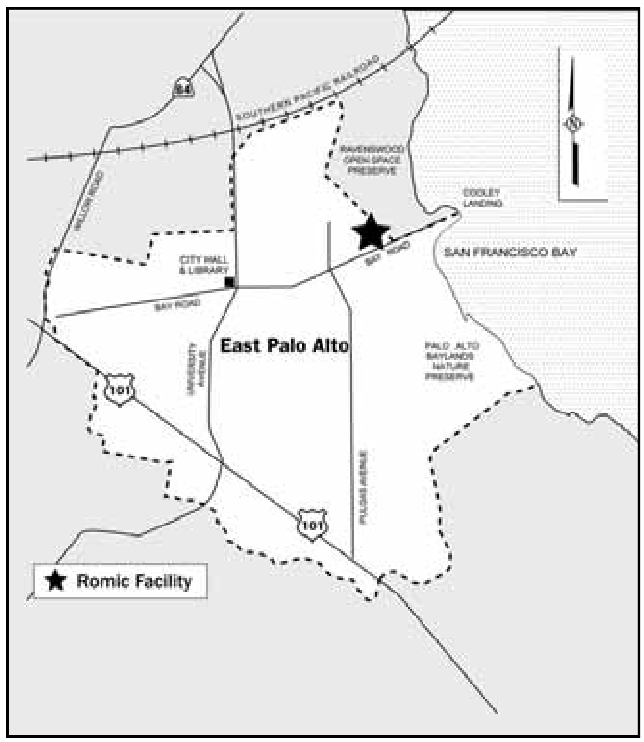

Figure 1 Site Location Map

Romic is a 14-acre facility which is located approximately ¼ mile from San Francisco Bay at 2081 Bay Road in East Palo Alto, California (Figure 1). This area of East Palo Alto is zoned for light and heavy industrial use. The Facility is bordered on the west, south, and part of the east by industrial and commercial properties. Among others, these properties include current or former auto-wrecking yards. The nearest residential neighborhood is approximately 1250 feet (0.25 miles) to the west of the Facility. To the south, Romic is bordered by Bay Road and beyond Bay Road by an electrical substation and a former chemical manufacturing facility (now vacant). On the east, Romic is bordered by a narrow tidal channel ("the east slough") which drains to San Francisco Bay. A former salt evaporation pond, which has been reclaimed as a wetland, is located between the slough and San Francisco Bay. Immediately north of the Facility, another channel ("the north slough") drains into the eastern tidal slough.

Hazardous waste operations were conducted primarily on the central portion of the Facility, which includes warehouses for storing and handling waste, tank farms, distillation processing equipment, a fuel blending area, and a field services chemical warehouse. A wastewater treatment plant is located on the south-central portion of the Facility. The administration, laboratory, maintenance building, and parking lots are also located on the southern portion of the Facility. Romic also owns adjacent land to the south, which it uses for a buffer zone. The Facility is surfaced with concrete, except in the equipment storage yard and southern parking lot which are surfaced with compacted gravel.

5.2 Operations History

Chemicals have been used, recycled, or processed at the Romic facility since the mid-1950s. In about 1956, Hird Chemical Corporation began operations at the Facility by constructing a chemical processing plant. Carad Chemical Corporation, who purchased the facility in 1959, operated it until 1963. In about 1964, P.D. Electronics purchased the Facility from Carad Chemical and Romic assumed operational responsibility. Romic purchased the Facility from P.D. Electronics in 1979. In January 1999, U.S. Liquids, a company based in Houston Texas that recycles liquid waste, purchased Romic. Subsequently, in 2003, Three Cities Research, Inc. purchased the Facility.

Most of Romic=s business involved processing solvent wastes and wastewaters from many sources, including industries that manufacture paint, ink, adhesives, automotive parts, aerospace components and electronics. Facility operations include: solvent recycling, (primarily distillation), fuel blending, wastewater treatment, and hazardous waste storage and treatment. Solvents are liquids used to dissolve or remove other substances. For example, solvents are used to remove grease from metal parts.

Currently, all hazardous materials or hazardous waste storage areas are constructed with secondary containment (i.e., concrete berms surrounding tanks or drum storage areas). The surface topography provides containment of fluids by sloping toward a central location where storm water is collected and managed under both industrial wastewater discharge and National Pollution Discharge Elimination System (NPDES) permits.

5.3 Potential Source Areas for Contamination

Past releases of hazardous wastes (e.g., spent solvents) and/or hazardous constituents from the central processing area, former drum storage areas and former wastewater receiving ponds have impacted soil and ground water at the Facility. These releases have occurred as a result of accidental spills, tank and container overfills, flooding events, and breaks in pipes. In addition, a trough connecting the central process area and the former wastewater receiving ponds also may have acted as a source of contamination.

One documented release to the environment occurred during the winter season of 1972-1973 when tidal flooding breached the levees resulting in discharge from the ponds to the sloughs. The California Regional Quality Control Board issued a Cleanup and Abatement Order on March 23, 1973, which estimated a release of approximately 20,000 gallons per day of waste liquids from the former east pond to the adjacent slough. As a result of the Order, Romic rebuilt levees, improved surface drainage, and connected to the sanitary sewer.

Twenty different Solid Waste Management Units (SWMUs) were identified in the 1989 RCRA Facility Assessment prepared by the California State Department of Health Services Toxic Substances Control Program, A.T. Kearney, Inc. and Science Applications International Corporation. These SWMUs include: (1) East Containment Pond, (2) West Containment Pond, (3) Waste Discharge Trough, (4) Historical Drummed Waste Storage Areas, (5) West Storage Area, (6) Process Area Sump, (7) Truck Parking Area, (8) Drummed Waste Staging Area, (9) Drum Crushing Area, (10) South Drum Storage Building, (11) North Drum Storage Building, (12) CSR Drum Storage Building, (13) Green Tank Bulk Waste Storage Area, (14) Brown Tank Bulk Waste Storage Area, (15) Centrifuge, (16) Centrifuge Roll-off Bins, (17) Administration/ Laboratory Building Septic Tank and Drainfield, (18) Process and Sanitary Sewer System and Wastewater Surge Tank, (19) Surge Tank Separator, and (20) Runoff Sump Separator.

Many of these potential sources of contamination have been investigated as part of previous Facility investigations; however, those that have not yet been evaluated, such as the Administration/Laboratory Building Septic Tank and Drainfield, will be evaluated during or following implementation of the Facility Closure Plan. The three primary contaminant source areas at the Facility are the former pond area, the central processing area, and the southwest storage area (Figure 2). These contaminant source areas are discussed in more detail in the following sections.

5.3.1 Former Pond Area

The Hird Chemical Corporation constructed the original chemical processing facility in the mid 1950s. At that time, the east and west ponds were constructed in the northern portion of the Facility (Figure 2). These ponds collected surface water runoff from the Facility and adjacent properties. Wastewater and waste material were also reportedly discharged to the ponds. A trough was used to transport wastewater from the central processing area to the former east pond. An estimated 100,000 gallons per week of wastewater was discharged to these ponds in the early 1970s. An outfall pipe transferred overflow from these ponds to the eastern slough. In 1973, under the supervision of the U.S. Army Corps of Engineers, the outfall pipe was decommissioned by sealing it with concrete. Thereafter, wastewater was discharged to the sanitary sewer under a permit from the East Palo Alto Sanitary District. Near the end of the 1970s, the ponds were decommissioned, backfilled and capped with concrete. Hazardous waste drum storage buildings were constructed on top of the former ponds.

5.3.2 Central Processing Area

Several potential contaminant source areas are grouped together and discussed as the central processing area. These areas include the central processing and bulk-product storage areas, formerly unpaved areas that were used for drum storage until 1980, and the wastewater discharge trough that moved wastewater from the central processing area to the former pond area. The drum storage was located on unlined or unpaved areas which possibly allowed for releases of wastes and reclaimed water contained in the drums to impact soils beneath the storage area.

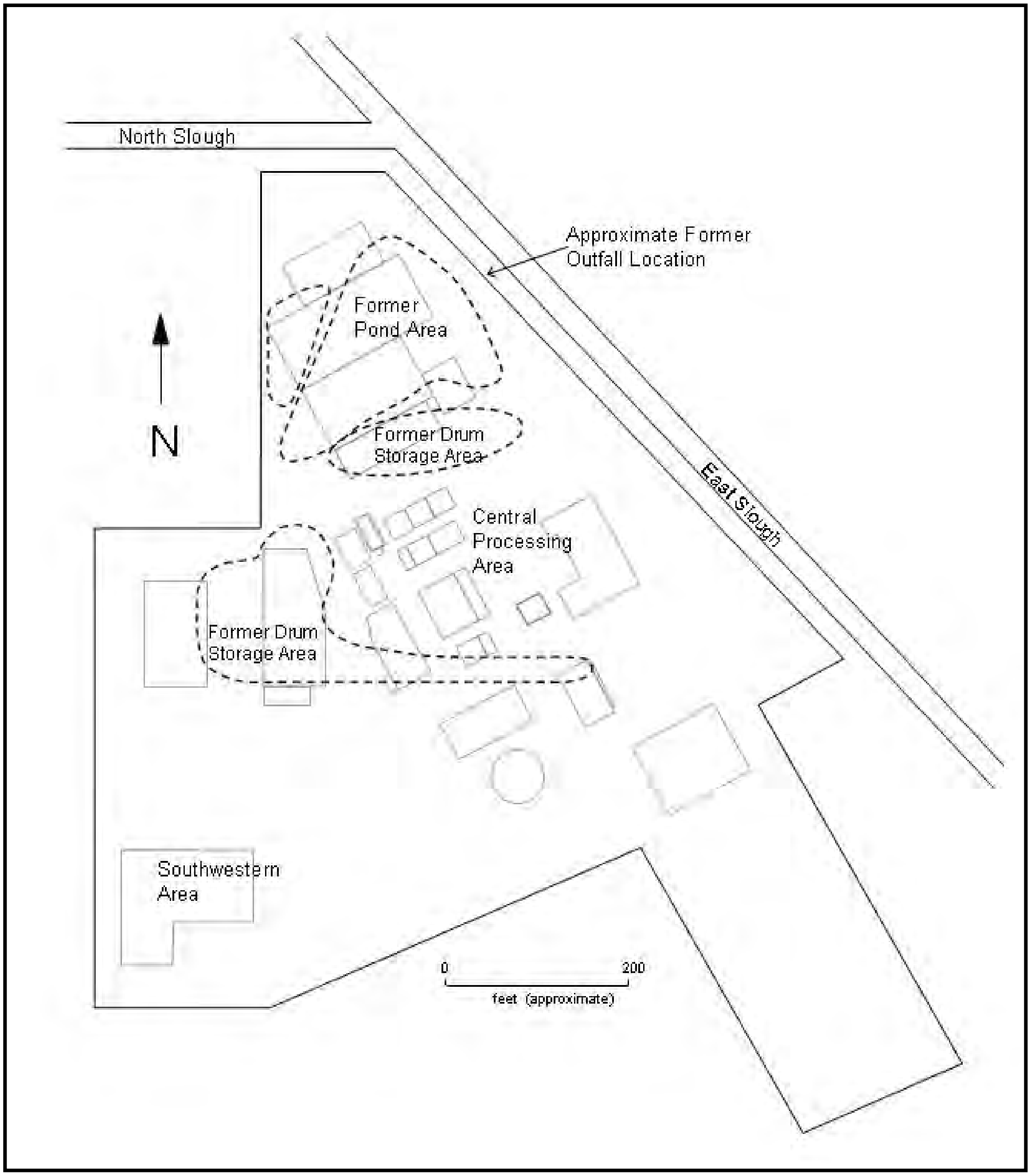

Figure 2 Potential Source Areas of Contamination

One of the two drum storage areas was located to the northeast between the former ponds and the central processing area. The second drum storage area was located to the south and southwest of the central processing area (Figure 2).

5.3.3 Southwest Drum Storage Area

Southwest of the central processing area was another unlined or unpaved drum storage area. Based on aerial photographs, Conor Pacific reported that approximately 1,000 to 1,500 drums could have been present at one time at the Southwest drum storage area. This drum storage area was decommissioned and is now covered with pavement and a building.

6. Environmental Setting

6.1 Geology

Romic is located on the southwest shore of San Francisco Bay. San Francisco Bay is a 40-mile long embayment bordered on the west by the Santa Cruz Mountains and on the east by the Diablo Range. Changes in sea level have resulted in the sequence of interbedded sand, silt and clay in the subsurface below the Facility (Figure 3). When the Earth was much cooler, large continent-size glaciers formed, locking up much of the ocean's water in ice. During these times, the sea level was much lower. San Francisco Bay was a valley with streams that flowed out through what is now the Golden Gate. Sand and gravel from the eroding Santa Cruz and Diablo Ranges filled the valley with coarse sediment. When the glaciers melted, the sea level rose, filling San Francisco Bay with seawater. During these times, fine sediment such as silts and clays were deposited. The alternating sequence of glacial and interglacial periods produced the sequence of interbedded sand, silt, and clay sediments seen at the Romic facility today.

6.2 Hydrogeology

The sand, silt and clay layers at the Romic facility have been subdivided into aquifer and aquitard units (Figure 3). Aquifers typically contain permeable sand and gravel zones; aquitards contain mostly clay layers, which are not as permeable as the sand/gravel aquifers. The units have been designated A, B, C, and D from shallowest to deepest. Ground water in all zones flows east toward San Francisco Bay. Ground water is brackish (salty) and unsuitable as a drinking water source. The City of

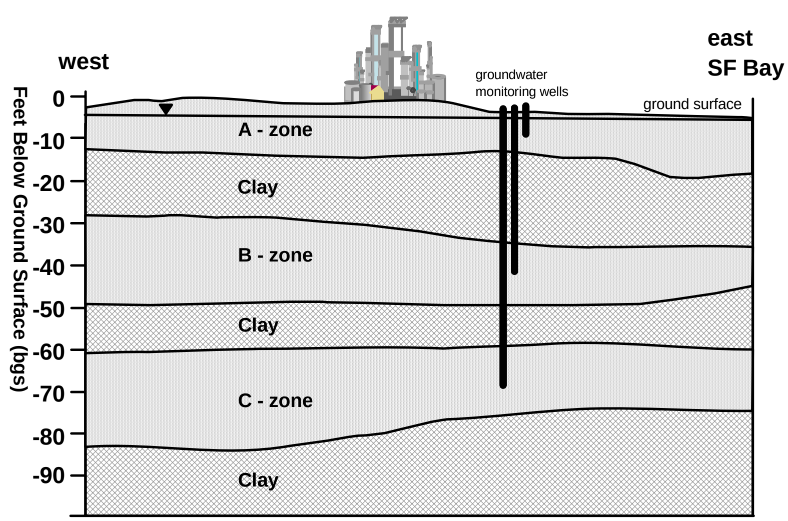

Figure 3 Generalized hydrogeology below the Romic facility

East Palo Alto does not use ground water near the Romic facility. The municipal water supply is largely derived from the San Francisco Hetch Hetchy Reservoir system.

Total Dissolved Solids (TDS) is a measure of the salt content of water. The maximum recommended TDS for drinking water is 500 milligrams per liter (mg/L). Due to Romic's proximity to San Francisco Bay, TDS in the A, B, and C zones exceeds not only the recommended TDS drinking water limit, but approaches (or exceeds) the TDS of seawater. TDS at Romic ranges from 1,200 mg/L to 36,000 mg/L. Seawater ranges from 30,000 to 40,000mg/L. South San Francisco Bay TDS ranges from 20,000 to 30,000 mg/L (USGS, 2002-2003 data).

The A-zone consists of clayey to silty sands and gravels interbedded with silts and clays. Grain size analysis of the A zone (1991) revealed primarily sand with fines (silt and clay) and limited gravel. The thickness of the A-zone ranges from 7 to 24 feet. TDS in the A-zone ranges from approximately 1,300 to 17,000 mg/L. Ground water velocity in the A-zone ranges from 10 to 300 feet/year.

Underlying the A-zone is the A/B aquitard, which varies from 8 to 25 feet thick. Available data indicates that the A/B aquitard is laterally discontinuous, which means that there may be gaps in the low-permeability clays. There may also be hydraulically connected sand zones that extend through the aquitard. These gaps allow contaminants to migrate to deeper zones.

The B-zone is similar to the A-zone, with clayey to silty sands and gravels interbedded with sandy silts and clays. Grain size analysis indicates that the B-zone is predominantly sand with relatively lesser amounts of silt and clay. The B-zone thickness varies from 3 to 31 feet and is thinner in the central and northern portions of the site. TDS in the B-zone ranges from approximately 21,000 to 36,000 mg/L. Ground water velocity in the B-zone ranges from 25 to 600 feet/year.

The B/C aquitard is similar to the A/B aquitard. Ranging in thickness from 9 to 24 feet, the B/C aquitard is also laterally discontinuous.

The C-zone, consisting primarily of sand and silty sand interbedded with silt and clay, ranges from 11 to 25 feet thick. Available data indicate that the C-zone is laterally continuous across the site, and is thickest in the central and northern areas. TDS in the C-zone ranges from approximately 1,200 to 28,000 mg/L. Ground water velocity in the C-zone is estimated to range from 4 to 20 feet/year.

The C/D aquitard is the most significant laterally continuous aquitard at the Romic site. Approximately 80 feet thick, the C/D aquitard is primarily clay, but includes thin lenses of sand or gravel.

The D-zone consists of sands and gravels. Only one well at the Romic site (well RW-16D) is completed in the D-zone, so there is little information on ground water flow. Available data indicates that the TDS is approximately 4,500 mg/L.

6.3 Surface Water

Surface water resources near Romic include two connected tidal channels (sloughs) and adjacent wetland (Figure 4). The north slough, which is a discharge point for East Palo Alto storm water runoff, drains to the east slough, adjacent to Romic. Both sloughs ultimately drain to San Francisco Bay. At high tide, water depth in the sloughs is approximately two to four feet. At low tide, the sloughs are nearly empty. The Facility is within the 100-year flood plain zone, but it is protected by a levee. No major stream channels are located near the Facility, except the two artificially created tidal sloughs. The wetland located east of Romic is a former salt evaporation pond. The former salt pond, now part of Ravenswood Open Space Preserve (Midpeninsula Regional Open Space District), is currently being restored to native marshland. The marsh attracts a variety of migrating birds including sandpipers,avocets, great blue herons, white pelicans, and egrets.

Figure 4 Aerial Photo of Romic (1994)

7. Extent of Contamination

Soil and ground water at the Romic facility are contaminated with hazardous constituents. Environmental investigations were first initiated at the Romic facility in April 1985. These investigations were performed to evaluate the nature and extent of contamination in the soil and ground water beneath the Facility and to evaluate the site's geological and hydrogeological conditions, and the effects of tidal cycles on site hydrogeology.

The primary contaminants in the soil and ground water are volatile organic compounds or VOCs. Typical VOCs include dry cleaning chemicals, carburetor cleaning liquids, paint thinners, and chemicals used to manufacture computers. VOCs are chemicals which evaporate easily. VOCs present at the Facility include chlorinated compounds such as trichloroethene (TCE), cis-1,2 dichloroethene (cis-1,2-DCE), 1,1-dichloroethane (1,1-DCA), and also ketones and tetrahydrofuran. A ketone (pronounced key-tone) is a chemical typically used as a solvent, or as a solvent stabilizer in paints or for other industrial uses. Ketones include such compounds as methyl ethyl ketone (MEK), methyl isobutylketone (MIBK) and acetone. Tetrahydrofuran is a solvent. Ketones and tetrahydrofuran are generally less toxic than chlorinated VOCs. Gasoline-related VOCs such as benzene, toluene, ethylbenzene, and xylene (collectively called BTEX, pronounced B-tex) are also present at the Facility.

Dense Non-Aqueous Phase Liquids (DNAPLs) are believed to be present below the contamination source areas (i.e., central processing area, former ponds, and drum storage areas). A DNAPL is a liquid that is denser than water and does not dissolve or mix easily in water (it is immiscible). In the presence of water DNAPLs form a separate phase from the water. Many chlorinated solvents, such as TCE, may be present at a hazardous waste site as a DNAPL and/or mixed with water (i.e., dissolved phase). DNAPLs are rarely found as a separate phase in monitoring wells, but their presence at a site can be inferred by site history, ground water contaminant concentrations, and contaminant trend analysis.

One well (RW-11A) near the western (upgradient) Facility boundary has a thin layer of oil as a Light Non Aqueous Phase Liquid (LNAPL). The LNAPL is believed to be confined to a relatively small part of the Facility. LNAPLs (e.g., petroleum products) are less dense than water and form a separate layer which floats on top of the water table. In monitoring wells, LNAPLs are found as a separate, oily product layer above the water table.

Ground water monitoring wells at Romic have been sampled for semi-volatile organic compounds (SVOCs), metals, polychlorinated biphenyls (PCBs), and dioxins/furans. SVOCs and metals have been detected in a few wells at concentrations which do not suggest a risk to receptors. Based on laboratory analytical results, dioxins and furans have not been detected in ground water at the Facility.

PCBs were detected in oily and sediment-entrained ground water samples, but have not been detected in any sediment-free ground water samples. PCBs are relatively immobile in ground water and unlikely to migrate to the slough.

VOCs have been detected in the surface water of the sloughs located to the north and east of the Facility. Concentrations of VOCs in the surface water currently do not exceed the surface water cleanup objectives (see Table 1 in Section 10). The surface water is monitored on a quarterly basis. The surface water analytical data is presented in Appendix B (“Table B-3, Surface Water Analytical Results for Northern and Eastern Sloughs”).

7.1 Horizontal and Vertical Extent of Ground Water Contamination

Ground water contamination extends below most of the Romic facility (Figure 5). The identified primary contaminant sources include the central processing area, the former surface impoundments, and former drum storage areas. Vertically, ground water contamination extends through the A-, B- and C-zones, or to approximately 80 feet below ground surface. The C-zone is separated from the D-zone by an 80-foot thick clay layer. Available data does not indicate that the D-zone is contaminated. See Appendix B, Table B-2 “Volatile Organic Compounds in Ground Water at Romic Facility” for a listing of the average and maximum VOC concentrations in each ground water zone and Figure 6, Wells Listed in Table B-2.

A total of 26 VOCs have been identified in A-zone ground water. VOCs detected include TCE, cis-1,2-DCE, 1,1-DCA, vinyl chloride, ketones, tetrahydrofuran, and BTEX.

The A/B aquitard is a "leaky" aquitard, which means that it does not perfectly prevent movement of contaminants from the A-zone to the B-zone. Contaminants have migrated from the shallow A-zone into the deeper B-zone. Some of the chlorinated solvents, where present as DNAPLs, are denser than water and have preferentially migrated to the deeper B-zone.

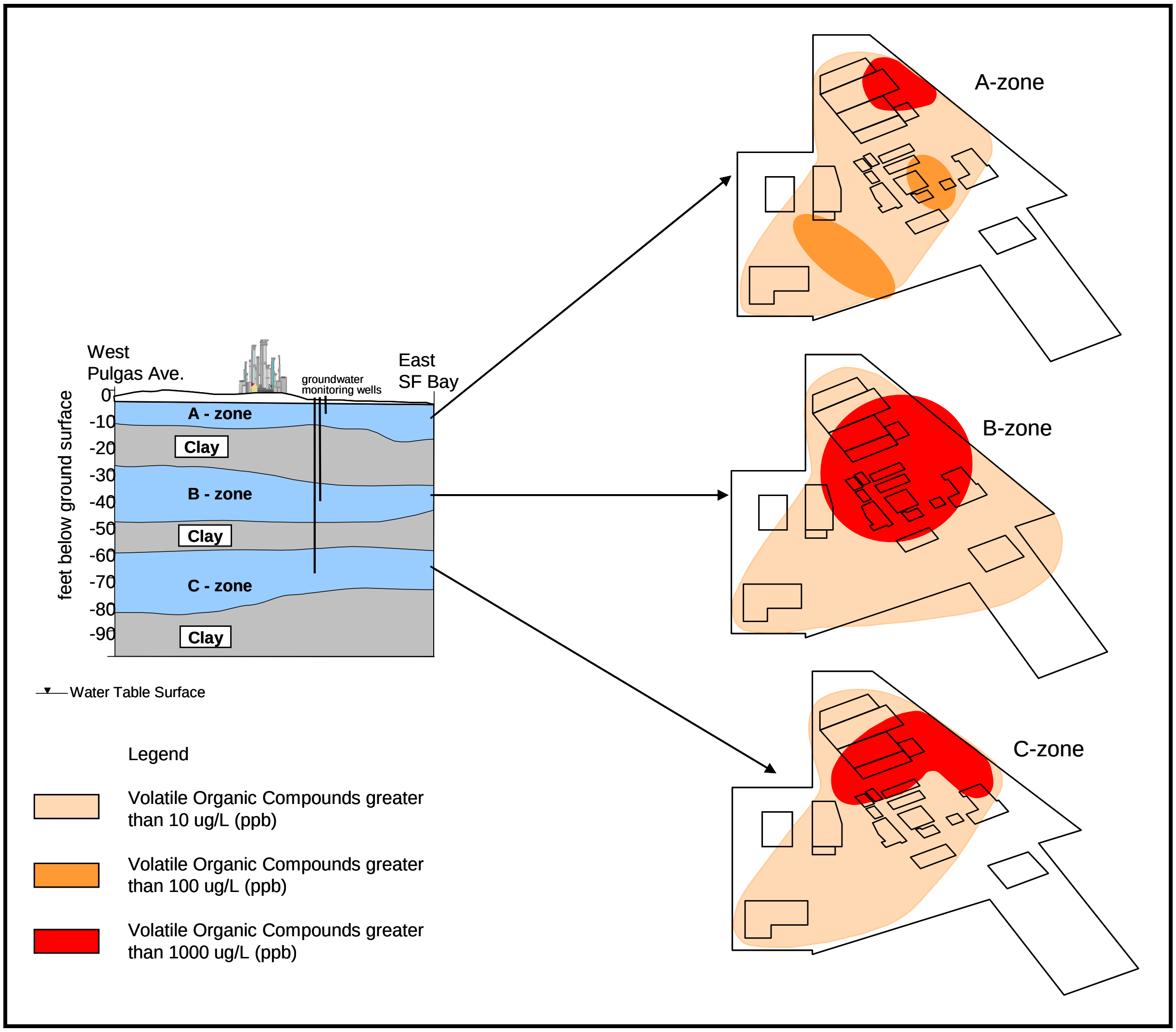

Figure 5 Vertical and Horizontal Extent of Contamination

Available data indicates the B-zone is more contaminated than the A-zone in some parts of the Facility, most notably the central processing area and western surface impoundment. The contaminants are similar to the A-zone, except that the B-zone generally has higher concentrations of chlorinated solvents and lower concentrations of ketones, tetrahydrofuran, and BTEX.

The B/C aquitard is also a leaky aquitard. Romic chemicals have migrated from the A-zone to the B-zone and to the deeper C-zone. The C-zone generally shows slightly lower contaminant concentrations than the B-zone. However, fewer ground water monitoring wells have been installed in the C-zone. Therefore, if necessary, further investigation will be conducted during the closure/remediation phase of the project to confirm the extent of contamination in the C-zone. The cheese whey/molasses remediation technology is just as effective in the C-zone as in the B-zone, so if additional areas of contamination are discovered, they will be addressed.

The C/D aquitard is the only significant aquitard at the Romic site. It is approximately 80 feet thick and provides a relatively robust barrier to contaminant migration from the C-zone. Only one ground water monitoring well is installed in the D-zone (RW-16D). Well RW-16D is not contaminated.

8. Exposure Assessment for Human Health and Ecological Receptors

This section of the SB summarizes the human health and ecological risk assessments that have been conducted based upon exposure to chemicals released at the Facility.

VOCs, SVOCs, and metals have been detected in soil and ground water at the Facility. PCBs were detected in oily and sediment-entrained ground water samples, but have not been detected in any sediment-free ground water samples. VOCs have been detected in surface water and sediments near the Facility. The primary contaminant sources are the former ponds and central processing areas located in the north-central portion of the Facility. Impacts to subsurface soil and ground water occurred due to release of hazardous waste and/or hazardous constituents and infiltration of these substances into surficial media, and through historical storm water overflow from the ponds into the adjacent tidal slough. Therefore, potential human and ecological receptors may be exposed to Facility-related chemicals in soil (surficial and subsurface), ground water, surface water and sediment.

8.1 Human Health Evaluation

Human health risk assessments (HHRA) were conducted and prepared for Romic by the following private environmental consulting firms: Dames and Moore (D&M 1991), Harding Lawson Associates (HLA 1991), EMCON (1993) and ENVIRON (1999). These HHRA's were prepared with U.S. EPA oversight. An additional risk assessment may be required by DTSC as part of the Facility Closure.

Conceptual Site Model

The conceptual site model incorporates the site-specific analytical data with constituent-specific fate and transport information to identify contaminant migration pathways. These migration pathways are correlated with human activity and use patterns to identify specific receptor subgroups and complete pathways of human exposure. The potentially exposed receptors and potentially complete exposure pathways are evaluated at the Romic facility in the various risk assessment reports.

Potentially Exposed Receptors

Romic was used as a treatment and storage facility that recycled solvents and treated hazardous wastes. Facility operations included solvent recycling, fuel blending, wastewater treatment and hazardous waste storage and treatment. The Facility is surfaced with concrete, except in the equipment storage yard and southern parking lot which are surfaced with compacted gravel. The concrete surface in the operational areas of the Facility prevents direct human exposure to the chemicals in surficial or subsurface soils or via wind dispersion if such soils were not covered.

Bordering the Facility to the southeast is an automobile dismantling facility, and to the northeast is a tidal slough and levee. The closest residential property is approximately 0.25 miles to the west and northwest, and San Francisco Bay is located approximately 0.25 miles east of the Facility. A maintained bicycle path runs along the levee bordering the Facility. The Facility will likely be redeveloped in the future; however, it is anticipated that the Facility will still be used for commercial and industrial purposes.

Based on the current and presumed future use of the Facility and surrounding areas, the following receptors were identified as potentially being exposed to chemicals at the Facility:

- On-site workers and nearby off-site workers working at the automobile dismantling facility,
- Adult and child recreational users of the bicycle path and tidal slough, and
- Adult and child residents living in the residential structures.

Potentially Complete Exposure Pathways

Consistent with U.S. EPA risk assessment guidance, an exposure pathway consists of the following four elements: (1) a source and mechanism of contaminant release to the environment; (2) a retention or transport medium for the released constituent; (3) a point of potential contact by the receptor with the impacted medium (the exposure point such as soil or ground water); and (4) a route of exposure to the receptor at the exposure point (e.g., ingestion, inhalation, or dermal contact). If any of these elements do not exist, the exposure pathway is considered incomplete, the risk is considered minimal (*de minimus),* and it is therefore not further evaluated in the human health risk assessment.

Presently, the Facility is covered with concrete except for some non operational areas that are covered with compacted gravel; therefore, direct contact with chemicals in soil is currently considered an incomplete pathway of human exposure. In addition, previous ground water investigations have demonstrated that the distribution of Facility-related chemicals in ground water is limited to the aquifer beneath the property (i.e., the A-, B-, and C-zones), particularly near the former pond and central processing areas. However, ground water in the A-, B-, and C-ground water zones is saline and therefore not usable for domestic, agricultural or industrial purposes. Thus, currently direct contact with chemicals in ground water is also considered an incomplete pathway of human exposure.

Recreational users could come into direct contact with contaminated sediment and surface water in the tidal slough near the bicycle path. However, this is considered unlikely because the areas where sediments are contaminated are not accessible for swimming or wading. Further, water-contact recreation, such as swimming and wading, is currently prohibited in this area. Even in areas where the banks are sloped, the slope is steep and the sediments are mucky, making wading any distance impossible.

Three previous risk assessments have evaluated the magnitude of potential health impacts from exposure to volatile contaminants in the surface waters of the tidal slough. The inhalation pathway of exposure was the sole human exposure pathway subject to quantitative analysis. All risk estimates associated with this exposure scenario were beneath or within EPA's target level for acceptable risk and hazard. Direct contact with contaminants in surface water and sediment, while not considered an incomplete pathway of human exposure, is considered to represent an infrequent exposure at best, the magnitude of which should not engender significant excess carcinogenic risk or non-cancer hazard.

Finally, exposure to VOCs in the slough sediment and surface water through consumption of fish and shellfish is not considered a complete exposure pathway because fish population surveys indicate that the fish in the tidal slough are few in number, small in size and are species not typically consumed by humans. Further, the Facility-related chemicals detected in slough sediment are not expected to bioaccumulate. The log octanol/water partition coefficients (log K_{ow}) for these compounds are low (less than 3), indicating little potential for bioaccumulation in the food chain. This is supported by the bioaccumulation study conducted by Jenkins, Sanders & Associates (JSA 1994), which demonstrated that Facility-related chemicals were not accumulated by clams inhabiting the slough sediment.

In summary, direct exposures (e.g., ingestion and dermal contact) to chemicals in soil, ground water, surface water, and sediment for all receptors are not currently complete or are not significant in magnitude given the locations of chemical release, migration pathways, and surrounding land uses. Therefore, the main exposure pathway to chemicals at the Facility is inhalation of VOCs in ambient air. The complete or potentially complete exposure pathways evaluated in the risk assessments are summarized below:

- Current and future on-site workers and nearby off-site workers at the automobile dismantling facility may be exposed to volatile chemicals in soil and ground water via inhalation of ambient air. Note that on-site workers and nearby off-site workers may also be exposed to volatile chemicals in soil and ground water via migration to indoor air through cracks in building foundations (i.e., vapor intrusion). This potentially complete exposure pathway was not quantitatively evaluated in any of the pre-existing risk assessments. This pathway will be assessed by both a screening-level comparison between contaminant concentrations in ground water and the San Francisco Bay Area Regional Water Quality Control Board Commercial/Industrial Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns (RWQCB 2005) and by a focused indoor air monitoring effort consistent with the land use restrictions/risk management plan (Section 4, Proposed Remedy for Soil and Ground Water Contamination) and Media Cleanup Objectives (Section 10, Media Cleanup Objectives).

- Adult and child recreational users of the bicycle path may be exposed to volatile chemicals in soil and ground water via inhalation of ambient air.

- Adult and child residents living in the nearby houses may be exposed to volatile chemicals in soil and ground water via inhalation of ambient air.

- Although boating in the area of the Romic facility is prohibited unless a permit has been obtained, the potential risks associated with exposure to chemicals in surface water via inhalation of ambient air by a recreational canoeist or kayaker in the slough were also assessed (ENVIRON 1999).

Human Health Risk Characterization

Using the human exposure and toxicity information, potential human health impacts for each chemical and selected exposure pathway were evaluated. Upper-bound excess lifetime cancer risks and non-cancer hazards were quantified. In addition, cumulative excess lifetime cancer risks (ELCRs) and hazard indices (HIs) were estimated by summing the upper-bound ELCRs or hazards across exposure pathways for individual receptors. As previously discussed, human health risk assessments were conducted by Dames & Moore (1991), Harding Lawson Associates (HLA 1991), EMCON (1993), and ENVIRON (1999).

Under the existing conditions at the Romic facility, the ELCR for all receptors are less than or within the USEPA (1991) target carcinogenic risk range (1×10^{-4} to 1×10^{-6}). The HIs for all receptors are less than 1, indicating that it is unlikely that adverse noncancer health effects would occur under the conditions evaluated.

Summary of ELCRs and HIs for Each of the Receptors

Receptor	**D&M 1991**		**HLA 1991**		**EMCON 1993**		**ENVIRON 1999**	
	HI	**ELCR**	**HI**	**ELCR**	**HI**	**ELCR**	**HI**	**ELCR**
Resident	0.00001 (lifetime)	4.4×10^{-7} (lifetime)	0.004 (adult) 0.03 (child-adult)	8×10^{-6} (adult) 1×10^{-5} (child-adult)	0.006	3×10^{-7}	NA	NA
Maximum Exposure Receptor/On-Site Worker	0.00008	3.1×10^{-6}	NA	NA	0.04	7×10^{-6}	NA	NA
Recreational User of Bike Path or Slough	NA	NA	0.003 (adult) 0.3 (child)	6×10^{-6} (adult) 7×10^{-6} (child)	0.008	1×10^{-6}	0.005 (adult)	6×10^{-8} (adult)
Sensitive Receptor (e.g., hospital, schools)	NA	NA	NA	NA	0.002	6×10^{-8}	NA	NA

NA = not applicable; receptor was not evaluated in the listed risk assessment.

Human Health Risk Assessment Conclusions

The results of the site characterization and human health risk assessments indicate that chemicals in soil, ground water and the adjacent tidal slough (surface water) do not pose unacceptable risks to human health under the conditions evaluated. However, exposure to volatile chemicals via inhalation of indoor air by on-site and nearby off-site workers has not been quantitatively evaluated. This potentially complete exposure pathway will be addressed through the adopting of ground water media cleanup objectives that are more stringent than the San Francisco Bay-RWQCB Commercial/Industrial Groundwater Screening Levels for Evaluation of Potential Vapor Intrusion Concerns (RWQCB 2005) and by a focused indoor air monitoring effort consistent with the land use restrictions/risk management plan (Section 4, Proposed Remedy for Soil and Ground Water Contamination). The media cleanup objectives are discussed in Section 10 of this SB.

8.2 Ecological Setting and Evaluation

This SB covers the proposed remedy for soil and ground water. Contaminated sediments in the slough adjacent to Romic's eastern boundary will be addressed in a later action.

Environmental Setting and Potential Ecological Receptors

The on-site operational areas of the Romic facility are covered with concrete and/or buildings. Romic is bounded to the north by a slough (north slough) which is a tributary to the slough on the eastern property boundary. Beyond the slough to the north is a limited tidal marsh area. The slough adjacent to Romic's eastern boundary is bounded by narrow strips of pickleweed. The bottom of the slough, which consists of several feet of fine-grained sediment, is approximately five to six feet below the ground surface at Romic and is approximately 10 feet below the bike trail on the levee. Although the slough receives full tidal action and is typically waterless during low tide, it also has emergent vegetation that provides potential forage and cover for ecological receptors.

A former saltwater evaporation pond east of the east slough receives muted tidal action and serves as a roosting location for large numbers of shore birds. The southwest corner of the salt pond has a higher interior elevation and supports an area of upland grasses and a transition zone to the mud flat that is occupied by pickleweed.

The area around the Romic facility supports numerous species of birds, fish and aquatic invertebrate species. While no mammals were observed during 1991 surveys, they are believed to be present based on their use of nearby marsh areas (JSA 1993). Two endangered species, including the salt marsh harvest mouse (*Reithrodontomys raviventris)* and California clapper rail (*Rallus longirostris obsoletus*), are believed to inhabit the marsh and wetlands areas around the Romic facility. A California clapper rail was observed in the east slough in November 1992. A State of California species of special concern, the salt marsh wandering shrew (*Sorex vagrans halicoetes*), is also believed to inhabit the marsh and wetlands areas around the Romic facility.

Previous Ecological Assessments

Three ecological assessments (HLA 1991; JSA 1993; and JSA 1994) have been performed to characterize potential risks to ecological receptors associated with exposure to surface water and sediments in the tidal slough bordering Romic. Results from those studies are summarized below.

HLA Ecological Risk Assessment

A predictive risk assessment for aquatic organisms, birds (herons) and mammals (salt marsh harvest mouse) for exposure occurring via consumption of contaminated food resources was conducted in 1991 (HLA, 1991). Results from this risk assessment predicted that impacts to aquatic organisms are not likely to be significant. The hazard quotient predicted for the salt marsh harvest mouse exposure to vinyl chloride was 2, while results for the heron produced hazard quotients for TCE and vinyl chloride greater than 1. A hazard quotient of one (1) indicates a potential exposure having adverse health effects. However, given the conservatism of assumptions in the risk assessment, these hazard quotients may not represent a true risk to these species or other similar species that may forage in the impacted portion of the east unnamed slough.

JSA Ecological Assessment

JSA (1993) conducted sediment and surface-water sampling in 1992 to identify the distribution of site-related chemicals in the eastern slough sediments. The results from this analysis indicated that the distribution of elevated VOC concentrations in sediment was limited to a 320-foot section of the slough near the former pond outfall. Toxicity testing was conducted using surface water and sediment from the slough, but there was reduced survival in all samples including controls. The reduced survival appeared to be independent of VOC exposure and may be related to sediment grain size. Results of a statistical analysis of benthic community samples for abundance, diversity, and species composition were typical of benthic communities in similar fine-grained sediments in the southern San Francisco Bay area. There was a large and diverse benthic invertebrate community. The benthic community analysis did not find significant differences in community parameters were detectable along the VOC concentration gradient.

JSA Bioaccumulation and Growth Study

JSA (1994) conducted an in-situ bioaccumulation and growth study to assess the potential for adverse effects on the benthic community and to evaluate the potential uptake of Site-related chemicals by resident prey that are consumed by birds that forage in tidal sloughs. The study used transplanted clams (*Macoma balthica*). The results of the bioaccumulation study indicated that clams did not measurably accumulate VOCs, nor were there statistically significant differences in clam growth.

Recent Sediment Sampling and Analysis

To follow up on previous sediment sampling, sediment samples were collected in the east slough in September 2006 and were analyzed for VOCs (Arcadis 2006). The concentrations and distribution of VOCs in sediment were compared with results obtained in the earlier sediment sampling events. The results of the comparison indicate that the concentrations and distribution of VOCs in sediment are similar to concentrations previously observed in the sampling conducted in the early 1990's. The September 2006 sampling event and results are further discussed in an ARCADIS (2006c) letter report.

Ecological Risk Characterization and Conclusions

The sediments of the east slough are contaminated with VOCs, primarily vinyl chloride. Three investigations were conducted to characterize risk associated with exposure to VOCs to ecological receptors in the east slough and a more recent sediment sampling event was conducted to evaluate current concentrations of VOCs in slough sediments. The three earlier investigations concluded that site-related chemicals in the sediment did not pose significant ecological impacts. At this time, U.S. EPA does not fully accept the conclusions of the three earlier investigations due to certain anomalies that occurred during the studies. As such, U.S. EPA is discussing these assessments with the U.S. Fish and Wildlife Service and other Trustee Agencies to determine appropriate further action. These discussions may result in additional ecological studies being conducted at the slough in the future. As discussed earlier, this SB covers the proposed remedy for soil and ground water. Contaminated sediments in the slough adjacent to Romic's eastern boundary will be addressed in a later action.

9. Interim Remedial Measures

U.S. EPA required that Romic implement two interim remedial measures at the Facility. The first measure was a ground water extraction and treatment system which began operations in 1993. The second interim remedial measure was enhanced biological treatment for contaminated ground water using cheese whey and molasses injections which started in 2001. Interim remedial measures are short-term actions taken to prevent human exposures to contaminants from a hazardous waste site, to control a source of contamination and/or to limit the spread of contamination prior to the implementation of a long-term remediation plan.

Romic operated a ground water extraction and treatment system from 1993 until 2003. Contaminated ground water was pumped from 10 wells and treated to remove harmful chemicals.

In 2001, Romic tested an enhanced biological treatment system in two areas of the Facility. Based on the results from the test locations, U.S. EPA determined that using enhanced biological treatment with cheese whey and molasses injections reduces contamination more effectively compared to the ground water extraction and treatment system. Thus, U.S. EPA requested that Romic replace the ground water extraction and treatment system with enhanced biological treatment. Romic, under oversight of the U.S. EPA, has expanded the enhanced biological treatment system to other areas of the Facility.

In 2001, as part of an initial pilot study, eight injection wells were drilled to inject cheese whey and molasses below the ground surface. Since then, the level of solvent contamination (such as TCE) has decreased by more than 95% in several locations.

The 2001 pilot tests showed that enhanced biological treatment can be improved by increasing the number of cheese whey and molasses injection points. In 2003, 12 new injection points were drilled an area along the eastern slough near San Francisco Bay. Increasing the number of injection points led to a substantial reduction of contaminants in the treatment area. In early 2005, 40 new injection points were installed along the slough and in other locations around the process plant. In 2007, 28 new injection points were installed on-site in areas along the eastern slough boundary.

10. Media Cleanup Objectives

U.S. EPA is proposing one media cleanup objective for ground water, one objective for surface water and one objective for indoor air vapor intrusion for future redevelopment. These proposed cleanup objectives are based on protection of human health and the environment. Each of the proposed media cleanup objectives are discussed below along with the compliance points (where cleanup levels should be achieved) and a timeframe goal for meeting the objectives (time to implement the remedy and achieve cleanup levels at the point of compliance). Table 1 lists the proposed media cleanup objectives for 24 of the 26 volatile organic compounds known to be present at the Facility. There are currently no published screening levels available for 1,1 -dichloropropene and isopropyl benzene. If screening levels for these compounds are developed in the future, they will be incorporated by reference into the future final remedy decision document

The proposed media cleanup objectives for ground water and surface water are taken from "Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, California Regional Water Quality Control Board, San Francisco Bay, Interim Final, February 2005" (Environmental Screening Levels), Table F-1a, Ceiling Value (Taste & Odor) and Drinking Water (Toxicity), and Table F, Estuarine Screening Levels. The proposed media cleanup objectives for indoor air vapor intrusion are taken from the U.S. EPA Region 9 Preliminary Remediation Goal Table, October 2004 (PRGs). Should the U.S. EPA at some time in the future revise the PRGs used for the cleanup objectives proposed in this SB, the most current PRGs available at the time of redevelopment shall apply to the Romic facility and be incorporated by reference into the final remedy decision document. If additional contaminants are identified at the Facility that are not listed on Table 1, applicable screening levels from the above cited documents as amended shall apply to the Romic facility and be incorporated by reference into the final remedy decision document. To the extent that this part of the SB is inconsistent with the documents cited above, the above cited documents shall control.

10.1 Cleanup Objectives

Ground Water **-** Maximum Contaminant Levels (MCLs) for drinking water are proposed as the site-wide media cleanup objectives for all ground water zones (A,B,C and D) (Table 1). The proposed ground water media cleanup objectives are the lowest of the California EPA Primary

MCLs for drinking water based on toxicity and Secondary MCLs based on taste and odor. U.S. EPA PRGs are used when there are no MCLs available for a given contaminant.

The proposed remedy is intended to eventually reduce contaminant concentrations in the impacted ground water to concentrations equal to or below the media cleanup objectives. The compliance point for this objective is the ground water in Zones A, B, C and D.

The proposed MCLs are both protective of human health and the environment and feasible for long-term property re-use. The proposed MCLs are all lower than the screening levels for vapor intrusion found in the RWQCB Environmental Screening Levels (Table E-1a) referenced above using the most conservative assumptions (residential landuse scenario and high permeability vadose zone soil type). The screening levels for vapor intrusion address the ground water to indoor air pathway.

The proposed objectives, with two exceptions, are all lower than the Aquatic Habitat Goal found in Table F-1a of the RWQCB Environmental Screening Levels. This media cleanup objective addresses ground water migration into surface water. Chlorobenzene and 1,1,1-trichloroethane are the two compounds where the proposed drinking water cleanup objective is higher than the corresponding Aquatic Habitat Goal. The differences are not significant for the purposes of evaluating the Romic facility. These compounds have never been detected in the surface water of the sloughs adjacent to the facility. See Appendix B, Table B-1 for a comparison of the proposed drinking water cleanup objectives to the vapor intrusion and aquatic habitat screening levels.

Ground water at the Facility is salty due to the close proximity to the San Francisco Bay. Thus, the ground water at the Facility is not currently being used as a drinking water supply and is not likely to be used for this purpose in the future. The majority of drinking water supplied to East Palo Alto residents and businesses is provided by the San Francisco Hetch Hetchy system, which originates in the Sierra Nevada Mountains. However, the ground water at the Facility is subject to the requirements of California's Porter-Cologne Water Quality Control Act and the San Francisco Bay Regional Water Quality Control Board's ("RWQCB") Basin Plan, which mandates the protection of waters of the state for beneficial uses including use as a potential drinking water source. Therefore, these cleanup objectives will apply to all three ground water zones for the ultimate restoration of ground water quality.

<u>Surface Water Estuarine Screening Level</u> **-** This media cleanup objective applies to surface water in the sloughs near the Facility. The estuarine screening levels are derived from various regulatory sources (e.g., California Toxics Rule, Criterion for Continuous Concentration) and generally represent the most stringent of available action levels for aquatic habitat protection. They are designed to be protective of both human health and the environment by accounting for potential bioaccumulation of chemicals in aquatic organisms and subsequent human consumption of these organisms. Locally, the areas south of the Dumbarton Bridge are considered to be estuarine.

<u>Indoor Air Vapor Intrusion Objective for Future Redevelopment</u> **-** Any future redevelopment of the Facility will need to meet U.S. EPA's risk-based concentrations for vapor intrusion. Specifically, the ambient air goals included in the U.S. EPA Region 9 PRGs (October 2004 and

Table 1 - Proposed Media Cleanup Objectives for Romic East Palo Alto			
Contaminant	**Ground Water Cleanup Objective[1]**	**Surface Water Cleanup Objective[2]**	**Indoor Air Vapor Intrusion Objective[3]**
	(ug/L)	(ug/L)	(ug/m^3)
Benzene	1	46	0.25
Chlorobenzene	50	25	62
Chloroethane	12	12	2.3
Chloroform	70	470	0.083
Dichlorobenzene, 1,2-	10	10	210
Dichloroethane, 1,1-	5	47	520
Dichloroethane, 1,2-	0.5	99	0.074
Dichloroethene, 1,1-	6	3.2	210
Dichloroethene, cis-1,2-	6	590	37
Dichloroethene, trans-1,2-	10	260	73
Dichloropropene, 1,1-	NA	NA	NA
Ethylbenzene	30	30	1100
Freon 113	59000[3]	NA	31000
Isopropyl benzene	NA	NA	NA
Methylene Chloride	5	1600	4.1
MTBE	5	180	7.4
Tetrachloroethene (PCE)	5	8.9	0.32
Tetrahydrofuran	1.6[3]	NA	0.99
Toluene	40	40	400
Trichloroethane, 1,1,1-	200	62	2300
Trichloroethane, 1,1,2-	5	42	0.12
Trichloroethene (TCE)	5	81	0.017
Trimethylbenzene, 1,2,4-	12[3]	NA	6.2
Trimethylbenzene, 1,3,5-	12[3]	NA	6.2
Vinyl Chloride	0.5	530	0.11
Xylenes (Total)	20	100	110

1 - "Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, California Regional Water Quality Control Board, San Francisco Bay, Interim Final, February 2005" (Environmental Screening Levels), Table F-1a, Ceiling Value (Taste & Odor) and Drinking Water (Toxicity)
2 – See 1 above, Table F, Estuarine Screening Levels
3 - US EPA Preliminary Remediation Goals (PRGs) - October 2004
ug/L - micrograms per liter
ug/m^3 - micrograms per cubic meter
NA -Not Available

any future revisions in effect at the time of redevelopment) will need to be met in any existing structures that remain in place or new structures built on the Facility property as part of a redevelopment project.

The PRG table lists the one in one million (10^{-6}) excess cancer risk concentrations and hazard index concentrations equivalent to 1 for non-carcinogenic compounds. Table 1 lists the PRG ambient air goals for the 26 VOCs present at the Facility. Although U.S. EPA generally allows a risk range of 1 in 10,000 (10^{-4}) to 1 in 1,000,000 (10^{-6}), we feel that using a (10^{-6}) value is protective because there are multiple volatile organic compounds present at Romic, and the PRG table is not considerate of cumulative effects of exposure to multiple chemicals.

10.2 Timeframe Goal for Meeting the Cleanup Objectives

The proposed goal for meeting the media cleanup objectives is seven years after Facility closure is completed. The timing is based on completion of Facility closure because most contaminated soils (contaminant source areas) are not currently accessible to investigation and remediation. Many of these areas are covered by buildings, tanks, and the process plant which are used in current Facility operations. Phase 2 remediation is directed at currently inaccessible areas that become available either during or after Facility Closure. Enhanced biological treatment is currently being used at Romic as an interim remedial measure. This technology is effective at reducing the concentration of VOC contaminants in soil and ground water as demonstrated by pilot testing and about five years of data gathered during on-site use as an interim remedial measure.

10.3 Achievement of Media Cleanup Objectives

Romic may petition U.S. EPA or the California agencies overseeing implementation of the remedy when it believes that the media cleanup objectives have been achieved in all or part of the Facility. The petition process is also applicable to any changes, adjustments or transitions Romic believes are needed for the remediation system. For example, Romic may petition U.S. EPA when it believes that monitored natural attenuation will be sufficient to meet the media cleanup objectives. The petition must include a rationale, data and other information that supports Romic’s request. U.S. EPA or California agencies overseeing implementation of the remedy will evaluate Romic’s petition and determine if it is acceptable at that time.

11. Remedial Technologies Evaluation

Romic is currently using enhanced biological treatment to remediate contaminated soil and ground water at several locations throughout the Facility as part of a U.S. EPA approved interim remedial measure. Romic has tested the effectiveness of this approach at the Facility and demonstrated that it works well in reducing contaminant concentrations. Thus, enhanced biological treatment is being proposed as the remedial technology to address soil and ground water contamination at the Facility. Alternatives development and evaluation is being done to provide further justification for the proposed remedy.

Remedial technologies for contaminated soil and ground water beneath the Romic facility were evaluated based on site-specific conditions, contaminant characteristics, and technical feasibility to determine which options should be used in developing the remedial alternatives. Based on this evaluation, the potential technologies discussed below were retained for use in the development of comprehensive remedial alternatives (Section 12). A number of technologies were screened out to eliminate those that are not applicable to the Facility. The technologies that were screened out are also discussed below along with the rationale for removing them from further consideration.

11.1 General Corrective Action Approaches

Corrective action typically relies on three general approaches to meet remedial objectives: (1) containment, (2) removal, and (3) treatment. Each of these general approaches can be a primary method of remediation, but they are typically used in conjunction with each other. The three general approaches are described below.

11.1.1 Containment

Containment involves isolating the contaminants and preventing their migration into the surrounding environment. Containment of soil involves installation of physical barriers, typically to prevent direct contact. Examples include low-permeability caps (covers), vertical barriers, such as slurry walls (wall constructed below ground surface using a clay slurry mixture) or hydraulic barriers such as extraction wells. Ground water extraction is regularly combined with on-site treatment technologies to reduce or eliminate contaminant concentrations before discharge of the extracted water.

11.1.2 Removal

This approach typically involves excavation of contaminated media (e.g., soils, sediments) and the subsequent on-site or off-site treatment or disposal at a permitted facility. The excavation resulting from removal requires backfilling and compaction with clean material.

11.1.3 Treatment

Treatment is done to permanently reduce or eliminate contaminant concentrations in both soil and ground water. Treatment involves a variety of thermal, physical, chemical, or biological methods.

Treatment can be done using in-situ (in-place) methods or ex-situ (aboveground) methods. Ex-situ methods are always coupled with techniques to bring contaminants aboveground. In-situ treatment often addresses contaminants in both soil and ground water concurrently (i.e., contaminants in saturated soil).

11.2 Technologies Retained for Developing Remedial Alternatives

The technologies and remedial approaches discussed below were evaluated and found to be appropriate for use at the Romic facility. They were combined into the three corrective action remedial alternatives discussed in Section 12.

No Action

The "No Action" approach is included to serve as a baseline for comparison with other corrective measures alternatives. This alternative does not include any investigation, remedial action, risk controls, monitoring, or site reviews, and relies only on natural mechanisms.

Institutional Controls

Institutional controls include any restrictions on the current and future use of the property and/or ground water. In light of the extent of soil and ground water contamination at the Facility, land use restrictions are necessary to protect human health and the environment, and to maintain the short and long term protectiveness of the remedy. For example, institutional controls could include limitations on extraction and usage of ground water, restrictions on excavation activities and prohibitions on how the property can be used such as for commercial and industrial purposes only.

Monitored Natural Attenuation of Ground Water

Monitored natural attenuation or MNA is an option premised on natural processes providing sufficient degradation and/or attenuation of target contaminants to meet remedial goals. These include physical (e.g., dilution, dispersion, volatilization), chemical (e.g., hydrolysis, precipitation), and biological degradation processes. Implementation of MNA typically involves continued monitoring of contaminant concentrations to quantify attenuation rates. MNA takes advantage of natural processes to attenuate residual contaminant concentrations. The only infrastructure required to implement MNA is an adequate monitoring network. Monitoring is normally infrequent (quarterly to annually), further minimizing the cost of implementation.

Containment with Ground Water Extraction

Ground water extraction is primarily used as a containment strategy, although some benefit of mass removal can be realized for dissolved contaminants. Lines of ground water extraction wells screened at an appropriate depth can be used to control the migration of contaminated ground water by altering the hydraulic gradient of the aquifer. Contaminated ground water is extracted and pumped to the surface for treatment before it can migrate off-site.

Ex-Situ Ground Water Treatment

Ex-situ or above ground treatment of extracted ground water includes a broad variety of physical, chemical and biological process options such as air stripping, carbon adsorption, ion exchange, filtration, various biological reactors, and ultraviolet oxidation. The ex-situ treatment process option retained for additional evaluation at the Romic facility is air stripping. Air stripping is an ex-situ physical treatment process. Removing volatile organic compounds or VOCs using air strippers is a common and established method for treating ground water. It is a widely used ground water treatment technology that is easy to install and operate.

Containment with Capping

The Romic facility is surfaced with concrete, except in the equipment storage yard and southern parking lot which are surfaced with compacted gravel. The option retained for soil containment involves maintaining the existing concrete cover over the contaminated soil and waste areas. This will prevent direct contact with contaminated soil and minimize contaminant migration through air, precipitation, percolation, wind, or run-off pathways. The main disadvantage of the containment cover is the need for long-term maintenance. A proper operation and maintenance (O&M) plan must be followed to ensure that the integrity of the cover is maintained.

In-Situ Treatment

In-situ (in-place) treatment can be more efficient and effective than ex-situ treatment techniques. In-situ physical, chemical, and biological treatments include a broad variety of process options such as enhanced biological treatment, air sparging, hydrofracturing, thermal treatment and chemical oxidation. The in-situ treatment process option retained for additional evaluation is enhanced bioremediation. This is an engineered bioremediation technique in which volatile organic compounds are degraded under anaerobic conditions through a series of transformations.

Enhanced biological treatment involves the injection of an easily degradable carbohydrate solution (e.g., molasses, cheese whey) into the ground water, which is metabolized by the naturally occurring microbes in the subsurface. The microbes breakdown the solvents, cheese whey, and molasses into carbon dioxide, water and salt similar to the way a septic system treats sewage from a home. Enhanced biological treatment is also safe because it relies on non-harmful microbes that occur naturally in soil. Romic is currently using this approach at the Facility.

Soil Excavation

Excavation can be achieved by employing standard excavation and construction equipment to remove contaminated soils. Excavation allows for the removal of buried hazardous waste, eliminating the environmental and health concerns associated with its presence and the possibility for future release of contaminants to the ground water. It is important to give careful consideration to the health and safety of remedial workers, and materials handling and transporting concerns must also be addressed.

Soil Disposal

After excavation, any contaminated soil shall be managed in accordance with all applicable provisions of state and federal laws.

11.3 Technologies Screened Out from Further Consideration

A number of remedial technologies were screened out from further consideration to eliminate those that are not applicable to the Romic facility. The technologies were screened out based on technical incompatibility with site conditions and contaminant characteristics.

The following technologies for soil and ground water remediation were screened out from further consideration and not used in developing the remedial alternatives:

- Vertical Barriers (e.g., slurry walls, sheet piling liners, vibrating beams, grout injection)
- Horizontal Barriers (e.g., liners, grout injection)
- Physical/Chemical In-Situ Treatment Processes (e.g., soil flushing, solidification/ stabilization, soil vapor extraction, fracturing)
- Biological In-Situ Treatment Processes (e.g., bioventing)
- Ex-Situ Treatment Processes for Mobility Reduction (e.g., solidification/stabilization)
- Toxicity Reduction (e.g. neutralization, incineration, biopiling)
- Volume Reduction (e.g., acid extraction, soil washing, vapor extraction, thermal desorption, electro-osmosis extraction)
- On-Site Landfilling

Appendix A contains a summary of each technology that was screened out. The summary describes what the technology is and why it was screened out from further consideration.

12. Development of Corrective Action Remedial Alternatives

Three corrective action remedial alternatives were developed from those technologies/ approaches that were considered feasible for the Facility. Some of the technologies used such as enhanced biological treatment and ground water extraction and treatment have been previously pilot tested or used at the Facility.

The proposed phased remedial approach and three remedial alternatives are discussed below.

12.1 Description of Phased Remedial Approach

Proposed remediation work at the Romic facility is divided into two phases in order to address contamination in currently inaccessible areas. Most contaminated media (in the contaminant source areas) is not currently accessible to investigation and remediation because those areas are covered by buildings, tanks, and the process plants used in the current operations at the Facility. The two phases split the corrective action work based on accessibility to contaminated media.

The first phase of work (Phase 1) will be directed at currently accessible contaminated areas and will take place during the operational life or during Closure of the Facility. The second phase of work (Phase 2) will be directed at the currently inaccessible areas as they become available during or after Facility Closure. During Phase 2, the potential source areas beneath the on-site buildings will be further investigated to provide additional information regarding the nature and extent of contamination in these areas.

The proposed remedy includes some excavation of soil as part of Phase 2; however, the necessary extent of any excavation(s) beneath the current buildings and structures cannot be determined until further investigation is conducted upon Facility Closure. At this time the only area potentially requiring soil excavation is on the western boundary of the Facility. In this area, near the drum storage buildings (Figure 2), some oil has historically been present on the surface of the ground water. The oil represents a potentially mobile source of contamination. In this area, excavation would be conducted to remove any oil residue or visible staining rather than to achieve a specific risk-based cleanup objective.

It is proposed that at some time in the future, active remediation will cease and the concentrations of contaminants in ground water will be allowed to decrease naturally to eventually achieve the cleanup objectives for restoration of ground water quality. This approach is called monitored natural attenuation or MNA. Romic may petition the U.S. EPA or California agencies overseeing implementation of the remedy when it believes that monitored natural attenuation will be sufficient to meet the media cleanup objectives. The petition shall include Romic's rationale, data, and other information that support the MNA approach for residual contamination. U.S. EPA or California agencies overseeing implementation of the selected remedy will evaluate Romic's petition and determine if it is acceptable at that time.

12.2 Remedial Alternatives

The following three remedial alternatives have been developed for further evaluation. The alternatives are as follows:

Alternative 1, No Further Action

Phases 1 and 2 - No Further Action

Alternative 2, Hydraulic Containment

Phase 1 - Cap Maintenance and Hydraulic Containment to Limit Off-site Migration

Phase 2 – Soil and Ground Water Investigation, Excavation, Replacement Capping in Redeveloped Areas*, Continued Hydraulic Containment to Limit Offsite Migration, Enhanced Biological Treatment in the Source Areas and MNA

Phase 1 and Phase 2 - Routine ground water monitoring, institutional controls (e.g., land use restrictions) and 5-year reviews

Assumptions for Alternative 2:

Phase 1 - Hydraulic Containment: Approximately 10 A-zone and 8 B-zone extraction wells installed along the eastern perimeter

Phase 2 - Enhanced biological treatment for source areas using carbohydrate Injections (e.g., cheese whey and molasses): Approximately 50 A zone injection points and monitoring wells, 100 B zone injection points and monitoring wells, and 60 C zone injection points and monitoring wells

Excavation and disposal of contaminated soils containing oil and/or other Facility related contaminants - approximately 3072 cubic yards

Total Cost (Alternative 2): $3,478,813

Alternative 3, Enhanced Biological Treatment

Phase 1 - Cap Maintenance and Enhanced Biological Treatment to Treat Accessible Source Areas and to Limit Off-site Migration

Phase 2 - Soil and Ground Water Investigation, Excavation, Replacement Capping in Redeveloped Areas*, Continued Enhanced Biological Treatment to Limit Off-site Migration, Expanded Enhanced Biological Treatment in the Source Areas and MNA

Phase 1 and Phase 2 - Routine ground water monitoring, institutional controls (e.g, landuse restrictions) and 5-year reviews

Assumptions for Alternative 3:

Phase 1 - Enhanced biological treatment for accessible source areas and to limit off-site migration using carbohydrate injections (cheese whey and molasses):

Approximately 11 A-zone injection points and monitoring wells, 9 B-zone injection points and monitoring wells and 13 C-zone injection points and monitoring wells were installed in August 2007 (not included in cost estimate).

Phase 2 - Continued enhanced biological treatment to control off-site migration and expanded enhanced biological treatment for source areas using carbohydrate injections (cheese whey and molasses): Approximately 72 A-zone injection points and monitoring wells, 124 B-zone injection points and monitoring wells and 76 C-zone injection points and monitoring wells

Excavation and disposal of contaminated soils containing oil and/or other Facility related contaminants - approximately 3072 cubic yards

Total Cost (Alternative 3): $2,544,453

*Redeveloped areas refers to locations where process units have been demolished/ removed and the concrete cap (cover) damaged

Alternative 1 includes no monitoring or maintenance and relies only on natural mechanisms. This alternative has been included as a baseline for comparison only. Alternatives 2 and 3 will both include routine ground water monitoring, institutional controls, and 5-year reviews. These components will be required to (1) monitor ongoing concentration reductions and confirm that off-site migration is being controlled, (2) to limit the potential for exposure to hazardous substances remaining at the Facility, and (3) to evaluate the long-term appropriateness of the selected corrective measures alternative.

13. Evaluation of Corrective Action Remedial Alternatives/Recommended Alternative

U.S. EPA uses a two step process to evaluate potential remedial alternatives. First, each alternative is compared to five remedy performance standards to determine if each alternative will:

(1) protect human health and the environment
(2) attain media cleanup objectives
(3) remediate the sources of releases
(4) control off-site migration of contaminated ground water
(5) limit potential for vapor intrusion into structures.

If one or more of the alternatives appear capable of achieving the remedy performance standards, those alternatives are evaluated against the following balancing/evaluation criteria to identify the preferred alternative:

(1) long-term effectiveness
(2) toxicity, mobility, and volume reduction

(3) short-term effectiveness
(4) implementability
(5) cost
(6) community acceptance
(7) state acceptance

The performance standards are fundamental criteria that U.S. EPA will use to evaluate remediation alternatives for the Romic facility. U.S. EPA is proposing and ultimately will select a remedy that it believes best meets the performance standards.

13.1 Step 1 - Evaluation Against Remedy Performance Standards

The five remedy performance standards for the Romic facility includes three general standards taken from a U.S. EPA guidance document titled, “Fact Sheet #3, Final Remedy Selection For Results-Based RCRA Corrective Action”, March 2000 and two site specific standards developed by U.S. EPA for the Facility. The general standards are: protect human health and the environment, attain media cleanup objectives, and remediate the sources of releases. The two site specific performance standards are: limit off-site migration of contaminated ground water and limit potential for vapor intrusion into structures. Each of the five standards are summarized below:

<u>Protect Human Health and the Environment</u>. Protection of human health and the environment is the general mandate from the RCRA statute and is thus included as the first performance standard for evaluating remedy alternatives at RCRA corrective action facilities. Among other things, U.S. EPA considers the reasonably anticipated land use(s), both now and in the future, when evaluating if a remedial alternative is protective of human health and the environment.

<u>Attain Media Cleanup Objectives</u>. The cleanup objectives address media cleanup levels (chemical concentrations), points of compliance (where cleanup levels should be achieved), and remediation timeframes (time to implement the remedy and achieve cleanup levels at the point of compliance). Cleanup levels for any medium (e.g., soil, ground water) are set at levels that are protective of human health and the environment. They are also based on appropriate assumptions regarding current and reasonably anticipated land use(s) and current and potential beneficial uses of water resources.

<u>Remediate the Sources of Releases</u>. Remediate the sources of releases so as to eliminate or reduce further releases of hazardous wastes or hazardous constituents that may pose a threat to human health and the environment. U.S. EPA believes that treatment should be used to address principal threats posed by a site whenever practicable and cost-effective. Contamination that represents principal threats for which treatment is most likely to be appropriate includes contamination that is highly toxic, highly mobile or contamination that cannot be reliably contained and that would present a significant risk to human health and the environment should exposure occur. “Sources” includes both the location of the original release as well as locations where significant mass of contaminants may have migrated. Note that while U.S. EPA expects facilities to use treatment technologies to

address principal threats, U.S. EPA also expects that containment technologies as well as institutional controls can be used to address wastes that pose relatively low long-term threats.

Limit Off-site Migration of Contaminated Ground Water.

This performance standard considers how effectively a remedy alternative limits the off-site migration of contaminated ground water. Ground water contaminated with VOCs is migrating off-site from the Romic facility to the northeast toward San Francisco Bay. Interim remedial measures using enhanced biological treatment are currently being used along the downgradient boundary of the facility to partially limit off-site migration. The final remedy alternative must include provisions that sufficiently limit off-site migration of contaminated ground water.

Limit Potential for Vapor Intrusion into Structures.

This performance standard considers how effectively a remedy alternative limits vapor intrusion from contaminated subsurface media into structures. Vapor intrusion is the migration of chemical vapors, primarily volatile organic compounds, from the subsurface into indoor air. Vapor intrusion occurs due to the pressure and concentration differentials between indoor and outdoor air. Indoor environments are often negatively pressurized with respect to outdoor air. This pressure difference allows subsurface vapors to preferentially migrate into indoor air. Contaminated subsurface matrices may include ground water, soil or soil gas. Contaminants of concern typically include halogenated VOCs such as TCE, PCE, and vinyl chloride, but may also include aromatic VOCs such as benzene, toluene and xylenes. Vapor intrusion has been identified as an important exposure pathway at many contaminated sites, including Superfund, RCRA, and Brownfield sites. The final remedy must include sufficient requirements and provisions that limit the potential for vapor intrusion into structures.

Alternative 1, the "No Action" alternative, will not meet the five remedy performance standards. As a result, Alternative 1 is not considered an acceptable corrective measures alternative, and is not evaluated further. Alternatives 2 and 3 both meet the five remedy performance standards. These alternatives include either hydraulic containment (Alternative 2) or enhanced biological treatment (Alternative 3) at the eastern property boundary to control off-site migration of contaminated ground water. They also include enhanced biological treatment to degrade contaminant mass in the source areas. Media cleanup objectives will be achieved through enhanced biological treatment followed by long-term monitored natural attenuation or MNA. Alternatives 2 and 3 also include institutional controls (e.g., landuse restrictions) and routine ground water monitoring and reporting to:

(1) measure ongoing concentration reductions
(2) confirm that off-site migration is being controlled
(3) limit the potential for exposure to hazardous substances remaining at the Facility
(4) evaluate the long-term appropriateness of the corrective measures alternative

Alternatives 2 and 3 are both considered protective of human health and the environment and are further evaluated below against the balancing criteria.

13.2 Step 2 – Evaluation Against Balancing Criteria

The seven balancing/evaluation criteria are defined as follows:

1. Long-term Effectiveness – The long-term reliability and effectiveness and the degree of certainty that the corrective measures will remain protective of human health and the environment. The magnitude of risks that will remain at the Facility from untreated wastes or treatment residuals and the reliability of any containment systems are also considered.

2. Toxicity, Mobility, and Volume Reduction – The degree to which treatment will be employed to reduce the toxicity, mobility, or volume of wastes, considering as appropriate: the treatment processes to be used and the amount of waste that will be treated, the degree to which treatment is irreversible, and the types of treatment residuals that will be produced.

3. Short-term Effectiveness – The short-term risks that will be posed to on-site workers and the surrounding community during the implementation of the corrective measures (e.g., through transportation-related risks, formation of contaminated dust, sediment disturbance). The amount of time required for remedy design, construction, and implementation is also considered.

4. Implementability – The ease or difficulty of remedy implementation, considering, as appropriate: the technical feasibility of constructing, operating, and monitoring the remedy; the administrative feasibility of coordinating with and obtaining necessary approvals and permits; and the availability of services and materials including the capacity and location of needed treatment, storage, and disposal services.

5. Cost – The estimated capital and operation, monitoring and maintenance costs, including the estimated total value of these costs.

6. Community Acceptance – The degree to which the corrective measures are acceptable to the interested community.

7. State Acceptance – The degree to which the corrective measures are acceptable to the state in which the subject facility is located. This is particularly important in cases where U.S. EPA, not the state, selects the remedy.

Alternatives 2 (Hydraulic Containment) and 3 (Enhanced Biological Treatment) are compared to the seven balancing/evaluation criteria as described below.

1. Long-term Effectiveness - As part of Alternative 2, limiting off-site migration of contaminated ground water is achieved via containment rather than actual treatment of contaminant concentrations along the property boundary. Extraction is considered a reliable containment system; however, Alternative 3 is a more effective long-term solution because contaminants will be permanently degraded and destroyed in-situ (in-place).

2. Toxicity, Mobility, and Volume Reduction - Treatment will be employed to a higher degree as part of Alternative 3. This alternative includes treatment of contaminated ground water along the eastern property boundary to limit off-site contaminant migration through active treatment/degradation of contaminant mass Alternative 2 will limit off-site contaminant migration by extracting contaminated ground water along the property boundary. The extracted ground water will be treated above ground; however, only limited contaminant mass removal is expected in comparison to the reductions associated with Alternative 3. The primary objective of the extraction system will be hydraulic containment rather than treatment.

3. Short-term Effectiveness - Alternative 2 includes ground water extraction and will require operation of an aboveground treatment system to treat the extracted ground water. Bringing contaminated ground water to the surface will result in increased potential for human exposure to contaminated media. Alternative 3 is based on expansion of the existing in-situ biological treatment system and therefore will require less time for remedy design, construction, and implementation.

4. Implementability - Both Alternatives 2 and 3 are considered technically feasible; however implementation of Alternative 2 may be more complex, since it would require treatment and discharge of the extracted ground water. In addition, permits may be required to discharge the treated water to the publicly-owned treatment works.

5. Cost - Alternative 2 maximum cost of $3,478,813 is higher than Alternative 3 cost of $2,544,453. The higher cost is associated with the ground water extraction system piping and construction, treatment system rehabilitation and start-up, as well as 15 years of system operation and maintenance. Both alternative costs include long-term ground water monitoring, enhanced biological treatment with injections of carbohydrate (cheese whey and molasses), and reporting.

6. Community Acceptance – Community acceptance of the proposed remedy will be evaluated after the public comment period.

7. State Acceptance - DTSC and the RWQCB have verbally concurred with U.S. EPA's proposed remedy.

13.3 Recommended Corrective Action Alternative

U.S. EPA has concluded that Alternative 3 (Enhanced Biological Treatment) best meets the corrective action standards and balancing/evaluation criteria. Based on all the information available to date, U.S. EPA believes that the proposed remedy is protective of human health and the environment. The proposed remedy has the best chance of attaining the cleanup objectives, remediating source areas, limiting off-site migration of volatile organic compounds from the source areas and limiting the potential for vapor intrusion into structures. Although residual contamination may remain in soil and ground water, U.S. EPA believes that the proposed remedy is still protective of human health and the environment.

Alternative 3 (Enhanced Biological Treatment) provides the following primary advantages over Alternative 2 (Hydraulic Containment):

- Phase 1 source area treatment (rather than simply limiting off-site migration) in the areas that are accessible prior to Facility Closure
- Contaminant degradation, rather than just containment at the property boundary
- Utilizes existing infrastructure at the property boundary, which was installed as part of the enhanced biological treatment pilot tests
- Reduced short-term risks, because no extraction of contaminants is necessary
- Greater reduction of toxicity, mobility, and volume of contaminants at a lower cost and shorter timeframe

Alternative 3 (Enhanced Biological Treatment) is U.S. EPA's recommended corrective action remedial alternative for the Romic facility.

14. Reference Documents

Key documents used as a reference in preparing this SB and remedy proposal are listed below:

ARCADIS 2001. Pilot Test Status Report, Romic Environmental Technologies Corporation, East Palo Alto, California. August 21.

________ 2003a. Monitoring Plan, Romic Environmental Technologies Corporation, 2081 Bay Road, East Palo Alto, California. April 24.

________ 2003b. Work Plan for Groundwater Interim Remedial Measures, Romic Environmental Technologies Corporation, 2081 Bay Road, East Palo Alto, California. June 13.

______ 2004. Start-Up Report – Interim Remedial Measures, Romic Environmental Technologies Corporation, 2081 Bay Road, East Palo Alto, California. May 14.

________ 2005. Work Plan for Expansion of the Groundwater Interim Remedial Measures, Romic Environmental Technologies Corporation, 2081 Bay Road, East Palo Alto, California. January 28.

______ 2006a. Start-Up Report – Expansion of the Interim Remedial Measures, Romic Environmental Technologies Corporation, 2081 Bay Road, East Palo Alto, California. March 6.

______ 2006b. Letter Report for the Data Gap Investigation, Romic Environmental Technologies Corporation, 2081 Bay Road, East Palo Alto, California. Letter to Ronald Leach. December 1.

______ 2006c. Letter Report for the Sediment Sampling, Romic Environmental Technologies Corporation, 2081 Bay Road, East Palo Alto, California. Letter to Ronald Leach. November 20.

________ 2007a. Work Plan for 2007 Expansion of the Groundwater Interim Remedial Measures, Romic Environmental Technologies Corporation, 2081 Bay Road, East Palo Alto, California. June 22.

________ 2007b. First and Second Quarter 2007 Semiannual Report, Romic Environmental Technologies Corporation, 2081 Bay Road, East Palo Alto, California. August 10.

________ 2007c. Corrective Measures Study Report, Romic Environmental Technologies Corporation, 2081 Bay Road, East Palo Alto, California. August 16.

A.T. Kearney, Inc. and Science Applications International Corporation 1987. RCRA Facility Assessment Preliminary Review Report. September.

California Regional Quality Control Board (RWQCB) San Francisco Bay Region 1973. Abatement Order 73-3. March 23.

________ 2005a. Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Volume 1: Summary Tier 1 Lookup Tables. February.

________ 2005b. Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, Volume 2: Background Documentation for the Development of Tier 1 Environmental Screening Levels. February.

California State Department of Health Services Toxic Substances Control Program, A.T. Kearney, Inc. and Science Applications International Corporation 1989. RCRA Facility Assessment of Solid Waste Management Units at Romic Chemical Corporation, East Palo Alto, CA. November.

Conor Pacific/EFW/Henshaw 1999a. Corrective Measures Study Report, Romic Environmental Technologies Corporation, 2081 Bay Road, East Palo Alto, California. March 8.
________ 1999b. Comprehensive RCRA Facility Investigation Report. March 31.

________ 1999c. Corrective Measures Study Report, Romic Environmental Technologies Corporation, East Palo Alto, CA. December 17.

Dames & Moore (D&M) 1991. Preliminary Risk Assessment of Volatile Organic Compounds in Soil Gas, Romic Chemical Corporation, East Palo Alto, California. March.

EMCON Associates 1993. Air Exposure Pathway Evaluation, Romic Chemical Corporation, East Palo Alto, California. October.

ENVIRON 1999. RFI Support: Risk Assessment from Recreational Visitors (Appendix G of Conor Pacific/EFW and Henshaw Associates, 1999 report). Letter- Report to Julia Bussey, ROMIC Environmental Technologies Corp. March 31.

Harding Lawson Associates 1991. Risk Assessment for the Tidal Slough, Romic Chemical Corporation, East Palo Alto. April 2.

Jenkins, Sanders & Associates (JSA) 1991. Preliminary Biological Evaluation of the Cooley Landing Salt Pond and the Surrounding Wetlands, East Palo Alto. December 6.

________1992. Biological Evaluation of the Cooley Landing Salt Pond and the Surrounding Wetlands, East Palo Alto. June 17.

________ 1993. An Ecological Assessment of the Slough Adjacent to Romic Facility, East Palo Alto, California. May 6.

________ 1994. In Situ Growth Study for Macoma balthica Exposed to Sediments of the Slough Adjacent to the Romic Facility, East Palo Alto, California–Final Report. November 17.

________ 1995 Addendum to In Situ Growth Study for Macoma balthica Exposed to Sediments of the Slough Adjacent to the Romic Facility, East Palo Alto, California–Final Report. June 30.

US EPA 1988. Administrative Order on Consent US EPA Docket No. RCRA-09-88-0015. December.

________ 1991. Groundwater Cleanup Studies Continue in East Palo Alto - Fact sheet. March.

________ 1997. US EPA Begins Process to Select Remedy for Contamination at Romic Facility - Fact sheet. September.

________ 1998a. Results of Metals Analysis for Cooley Landing - Memorandum. February 16.

________ 1998b. Cooley Landing Salt Pond Sediment Sampling - Memorandum. May 26.

________ 1999. Soil and Groundwater Remedy Evaluation at Romic, East Palo Alto - Fact Sheet. September.

________ 2000. Final Remedy Selection for Results-Based RCRA Corrective Action - Fact Sheet. March.

________ 2003a. Update of Activities, Romic Environmental Technologies Corporation - Fact Sheet. June.

________ 2003b. Romic Uses Cheese Whey and Molasses to Treat Contaminated Groundwater - Fact Sheet. October.

______ 2004. User's Guide and Background Technical Document for US EPA R9's Preliminary Remediation Goals (PRG) Table. October.

________ 2006. Romic Expands Treatment of Contaminated Groundwater - Fact Sheet. September.

________ 2007. U.S. EPA Requests Public Comment on Proposed Remedy (Cleanup) for Romic East Palo Alto Facility - Fact Sheet. September.

Glossary of Terms

Administrative Order - A legal agreement signed by U.S. EPA and an individual, a business, or other entity through which the responsible party agrees to perform or pay the cost of a site Remediation. The order describes actions to be taken at a site and can be enforced in court. A consent order does not have to be approved by a judge.

Administrative Record - The documents and information that are considered or relied upon to make a remedy selection decision for a site. These documents are available for public inspection usually at the nearest public library to the site.

Aerobic - with oxygen, or oxygen-rich. Aerobic groundwater typically contains greater than 0.5 mg/l dissolved oxygen.

Anaerobic - without oxygen, or very low in oxygen. Anaerobic groundwater typically contains less than 0.5 mg/l dissolved oxygen.

Aromatic VOC's or Aromatic Volatile Organic Compounds include, but are not limited to, benzene, toluene, ethylbenzene and xylenes.

Aquifer - An underground formation composed of materials such as sand or gravel that can store and supply ground water to wells and springs.

BTEX - Abbreviation for the compounds benzene, toluene, ethylbenzene and xylene.

Cal-EPA or California Environmental Protection Agency, DTSC or Department of Toxic Substances Control, or Department of Health Services (DHS), DTSC - The state agency which is responsible for regulating hazardous waste in California. DTSC has the authority to enforce federal and state hazardous waste regulations.

Chlorinated Solvents - See Ahalogenated VOCs.@ Chlorinated solvents are a subset of halogenated VOCs.

Corrective Action - Those actions taken to investigate and clean-up contaminant releases from hazardous waste treatment, storage, and disposal facilities.

Corrective Measures Study (CMS) – A study conducted by the facility owner or operator to identify and evaluate alternative remedies to address contaminant releases at a site.

Corrective Measures Implementation (CMI) - During the CMI, the facility owner or operator designs and constructs the remedy selected by U.S. EPA. The owner or operator must also operate, maintain, and monitor the system after construction.

DNAPL **-** Dense, Non-Aqueous Phase Liquid. A chemical compound which is liquid at ambient temperature, and denser than water. Generally refers to highly concentrated volumes of chlorinated solvents such as trichloroethene, tetrachloroethene, or their transformation products. Because these chemicals are denser that water, they can move down through the water table and contaminate deeper aquifers. Also used to describe less volatile compounds such as creosote and other wood-treating chemicals.

Downgradient - Similar to downstream, ground water flows from upgradient to downgradient.

Environmental Screening Levels (ESLs) - ESLs are chemical specific, risk-based concentrations developed by the San Francisco Bay Regional Water Quality Control Board, and are for use as screening levels in determining if further evaluation is warranted, in prioritizing areas of concern, in establishing initial cleanup goals, and in estimation of potential health risks. For carcinogens, the ESLs are based on a target excess cancer risk of one in a million. This represents the upper (most health protective) end of the potentially acceptable range of in ten thousand to one in a million recommended by the US Environmental Protection Agency (EPA) for contemplating remediation of sites.

Ex-situ Treatment - Removal of contaminated media from underground to the surface for treatment.

Ground Water - Water, found beneath the earth's surface, which often supplies wells and springs.

Halogenated VOC's or Halogenated Volatile Organic Compounds include, but are not limited to, the following compounds that contain chlorine: tetrachloroethene (PCE), trichloroethene (TCE), 1,1-dichloroethene (1,1-DCE), 1,1-dichloroethane (1,1-DCA), 1,2- dichloroethane (1,2-DCA), trans-1,2-dichloroethene (1,2-DCE), carbon tetrachloride, 1,1,1-trichloroethane (1,1,1-TCA), chloroform and methylene chloride.

In-situ Treatment - Treatment of contamination in-place.

Interim Remedial Measures - Short-term actions taken to prevent human or environmental exposure to contaminants from a hazardous waste site, to control a source of contamination, or to limit the spread of contamination prior to the implementation of a long-term remedy plan.

Land Use Restrictions or "Covenant to Restrict Use of Property" - A clause in a deed restricting the manner in which a property can be used, based on a remaining environmental issue. For example, a deed for a residential property may contain restrictions that would prohibit water wells on the property, due to underlying ground water pollution.

RCRA Facility Assessment (RFA) - A detailed review of records and information on the facility to identify and characterize all solid waste management units at the site; this

includes a site inspection to examine all parts of the facility and identify areas of potential contamination.
Regional Water Quality Control Board, San Francisco Bay Region (RWQCB) - The State agency tasked with protecting water resources in the greater San Francisco Bay area.

Semivolatile Organic Compound (SVOC) – An organic (carbon containing) compound that does not evaporate easily at room temperature. SVOCs at the Romic facility include isophorone and bis (2-chloroisopropyl) ether.

Solid Waste Management Unit (SWMU) - Any discernable unit at which solid wastes have been placed at any time, irrespective of whether the unit was intended for the management of solid or hazardous waste. Such units include any area at a facility at which solid wastes have been routinely or systematically released.

Maximum Contaminant Level or MCL means the maximum permissible level of a contaminant in water delivered to any user of a public water system. MCLs are enforceable standards. Primary MCLs take in to account a chemical's health risks and include a high margin of safety.

Metals (heavy metals) - Metallic elements with high atomic weights, such as chromium, cadmium, arsenic and lead. Heavy metals can damage living things at low concentrations and tend to accumulate in the food chain.

Polychlorinated biphenyls (PCBs) - Polychlorinated biphenyls are a group of man-made chemicals that contain 209 different compounds with varying toxicity. PCBs have been used widely as coolants and lubricants in transformers, capacitors and other electrical equipment. The manufacture of PCBs in the United States stopped in 1977 because of evidence that PCBs accumulate in the environment and may cause health hazards.

Pozzolan - A pozzolan is a material which, when combined with calcium hydroxide, exhibits cementitious properties. Pozzolans are commonly used as an addition to Portland cement mixtures to increase the long-term strength and other material properties of portland cement concrete.

RCRA Facility Investigation (RFI) - An in-depth study to determine the nature and extent of contamination at a RCRA treatment, storage, or disposal facility; establish criteria for remediating the site; identify preliminary alternatives for remediating the site; and support the technical and cost evaluation of the alternatives.

Resource Conservation and Recovery Act (RCRA) - A federal law that established a regulatory system to track hazardous waste from the time of generation to disposal. The law requires facilities to obtain a permit if they treat, store or dispose of hazardous waste. RCRA is designed to prevent new, uncontrolled hazardous waste sites.

Risk-Management Plan - The risk management plan contains practical ways to mitigate risk for occupants and workers presented by exposure to pollutants that are present in soil and/or groundwater on a property. Such measures often engineering controls (i.e. capping with asphalt or buildings) and institutional controls (deed restrictions, preventing certain uses of a property). This document also serves to disclose site conditions and provide public information.

Slough - A creek in a marsh or tidal flat. The sloughs north and east of the Romic facility drain into San Francisco Bay.

Trichloroethene (TCE) - A liquid used as a solvent, metal degreasing agent, and in other industrial applications. TCE may be a human carcinogen.

μg/l - Micrograms of contaminant per liter of water, approximately equivalent to parts per billion.

Vadose Zone - The zone between the land surface and the surface of the saturated zone. The surface of the saturated zone is also referred to as the ground water table.

Volatile Organic Compound (VOC) - Any organic (carbon containing) compound that evaporates easily at room temperature. VOCs are commonly used in dry cleaning, paint stripping, metal plating, and machinery degreasing.

Well - A bored, drilled, or driven shaft whose purpose is to reach underground water (ground water). In the case of the Romic facility, there are two types of wells in the area; monitoring wells which are used for gathering samples in order to detect and evaluate ground water pollution, and injection wells which are used to inject cheese whey and molasses into contaminated ground water for enhanced biological treatment.

10^{-4} to 10^{-6} lifetime cancer risk: A 10^{-4} to 10^{-6} lifetime cancer risk illustrates a range of the theoretical likelihood of developing cancer as a result of the environmental exposure of interest. The range represents the probability of developing cancer in excess of the background cancer rate. In the United States, roughly 33% of the population will develop cancer over the course of their life, which means that, on average, approximately 333,000 individuals in a population of one million individuals, will develop cancer. A 10^{-4} risk represents one additional case of cancer in a population of 10,000 (or 100 in a population of one million), while a 10^{-6} cancer risk level suggests that one additional case of cancer will develop in a population of one million.

Appendix A

Technologies Screened Out from Further Consideration

Appendix A - Technologies Screened Out from Further Consideration

The following technologies were screened out and not considered for inclusion in the comprehensive remedial alternatives developed for the Romic facility.

►***Method: Vegetative Cover (Containment, Capping)***

What is it? Uncontaminated soil is placed over contaminated soil to minimize exposure to contaminated surface soil. A vegetative layer could be installed over the uncontaminated soil layer to minimize erosion.

Why was it screened out? A vegetative cover would be potentially applicable, however existing asphalt/concrete cover serves similar purpose.

►***Method: Slurry Wall, Sheet Piling Liners, Vibrating Beam, Grout Injection (Containment, Vertical Barriers)***

<u>Slurry Wall</u> **-** A trench is excavated around soil contamination and filled with concrete or soil-bentonite to limit horizontal migration of contaminants. The slurry wall can also be used to in conjunction with extraction wells to hydraulically control migration of contaminated ground water.

<u>Sheet Piling Liners</u> - Sheet piles are driven around the contaminated area to limit horizontal migration of contaminants.

<u>Vibrating Beam</u> - A steel beam is placed into the ground, and then withdrawn as concrete slurry is injected to limit horizontal migration of contaminants.

<u>Grout Injection</u> - Grout is pressure-injected around contaminated area to limit the horizontal migration of contaminants.

Why was it screened out? Ground water contamination at the Romic facility extends to a depth of about 80 feet where vertical barriers are not feasible.

►***Method: Liners (Containment, Horizontal Barriers)***

What is it? Impermeable liners are placed in pits to restrict vertical transport and leaching.

Why was it screened out? Not feasible to implement at sites with existing contamination such as Romic, most often used as a landfill technology.

►***Method: Grout Injection (Containment, Horizontal Barriers)***

What is it? Grout is pressure-injected around contaminated area to limit the horizontal migration of contaminants.
Why was it screened out? Grout injection would not reduce potential for exposure to surface soils.

►***Method: Soil Flushing (In-Situ Treatment, Physical/Chemical)***

What is it? Solvents are injected into the subsurface. Soluble contaminants are leached out of the soil matrix and recovered through pumping.

Why was it screened out? Soil flushing is not applicable to the Romic facility for the various types of contaminants in the soil. The shallow ground water also prevents the effective use of soil flushing.

►***Method: Solidification/Stabilization (In-Situ Treatment, Physical/Chemical)***

What is it? Soil is treated with organic polymers, lime, cement, or pozzolan materials using earth-moving equipment, pneumatic injectors or hollow-stem augers to stabilize/solidify contaminants (particularly metals) in solid matrix.

Why was it screened out? Metals are not detected consistently in ground water, even in areas where metals are detected in soil, indicating that leaching from soil to ground water is not occurring and that solidification/stabilization is unnecessary.

►***Method: Soil Vapor Extraction (In-Situ Treatment, Physical/Chemical)***

What is it? Vacuum is applied to extraction wells. Volatile contaminants in the subsurface are extracted out by the vacuum and treated on the surface.

Why was it screened out? Soil vapor extraction is not applicable for use at the Romic facility due to the shallow ground water which is only a few feet below the ground and would clog the vacuuming system.

►***Method: Fracturing (In-Situ Treatment, Physical/Chemical)***

What is it? Fluids are injected into the subsurface to create new fissures and enhance existing fissures to improve soil conditions for in-situ treatment.

Why was it screened out? Fracturing is not applicable for treatment of surface soils and could damage injection wells by creating excessive pressures.

►***Method: Bioventing (In-Situ Treatment, Biological)***

What is it? Vapor extraction wells are used to induce air flow in the subsurface, enhancing microbial degradation processes.

Why was it screened out? Bioventing is not applicable for use at the Romic facility due to the shallow ground water which is only a few feet below the ground surface. The shallow ground water would greatly limit any airflow in subsurface soils thus preventing any effective biological breakdown of contaminants. In addition, Bioventing is not applicable for the various types of contaminants in the soil at the Facility (e.g., chlorinated solvents).

►***Method: Solidification/Stabilization (Ex-Situ Treatment, Mobility Reduction)***

What is it? Excavated soil is mixed with organic polymers, lime, cement, or pozzolan materials using earth-moving equipment to solidify/stabilize contaminants (particularly metals) in solid matrix.

Why was it screened out? Metals are not detected consistently in ground water, even in areas where metals are detected in soil, indicating that leaching from soil to ground water is not occurring and that solidification/stabilization is unnecessary.

►***Method: Neutralization (Ex-Situ Treatment, Toxicity Reduction)***

What is it? Either acidic solutions are added to alkaline wastes or basic solutions are added to acidic wastes to adjust pH.

Why was it screened out? Neutralization is not applicable for the various types of contaminants in soil and ground water at the Facility (e.g., trichloroethylene).

►***Method: Incineration (Ex-Situ Treatment, Toxicity Reduction)***

What is it? Contaminants are destroyed by combustion.

Why was it screened out? Excessive energy use due to saturated soils and lack of public acceptance.

►***Method: Biopiling (Ex-Situ Treatment, Toxicity Reduction)***

What is it? Bulking agents are added to excavated soil, then aerated to allow for destruction of organic chemicals by aerobic biological processes.

Why was it screened out? Biopiling is an aerobic process. It will not work for the contaminants of concern at the Romic facility which only degrade in an anaerobic environment.

►***Method: Acid Extraction (Ex-Situ Treatment, Volume Reduction)***

What is it? Extraction of acid-soluble contaminants using acidic solutions.

Why was it screened out? Acid Extraction is not applicable for the various types of contaminants (e.g, volatile organic compounds) in soil at the Facility.

►***Method: Soil Washing (Ex-Situ Treatment, Volume Reduction)***

What is it? Excavated soil is screened, classified and treated by scrubbing, abrasion, or pressurized steam.

Why was it screened out? Soil washing is not applicable for the various types of contaminants (e.g., volatile organic compounds) in soil at the Facility.

►***Method: Vapor Extraction (Ex-Situ Treatment, Volume Reduction)***

What is it? Volatile organic compounds are removed from excavated soil by mixing and applying a vacuum. The vacuumed contaminants must be captured and treated.

Why was it screened out? The high water table makes soil vapor extraction infeasible.

►***Method: Thermal Desorption (Ex-Situ Treatment, Volume Reduction)***

What is it? Soil contaminants are desorbed from contaminated soils at temperatures from 500 to 800 degrees Fahrenheit. The desorbed contaminates must be captured and treated.

Why was it screened out? The large volume of volatile organic compound contaminated soils (saturated with water) makes thermal desorption not practical for use at the Facility.

►***Method: Electro-Osmosis Extraction (Ex-Situ Treatment, Volume Reduction)***

What is it? Contaminants are extracted from soils using electrodes and a purging solution.

Why was it screened out? Electro-osmosis extraction is not applicable for the various types of contaminants in soil at the Facility. The large volume of volatile organic compound contaminated soils (saturated with water) makes electro-osmosis extraction not feasible for the Facility.

►***Method: On-site landfill (Soil Disposal, On-site)***

What is it? Excavated soil is disposed of on-site in an appropriately designed and permitted management unit (e.g, landfill).

Why was it screened out? Constructing an on-site landfill at the Romic facility is technically impractical due to the shallow ground water which is only a few feet below the ground surface. In addition, leaving large volumes of contaminated soils at the Facility is not a favorable technology from a regulatory or public acceptance perspective.

Appendix B

Table B-1, Comparison of Proposed Drinking Water Cleanup Objectives to the Vapor Intrusion and Aquatic Habitat Screening Levels

Table B-2, Volatile Organic Compounds (VOCs) in Ground Water at Romic Facility

Figure 6, Wells Listed in Table B-2

Table B-3, Surface Water Analytical Results for Northern and Eastern Sloughs

Table B-1. Comparison of Proposed Drinking Water Cleanup Objectives to the Vapor Intrusion and Aquatic Habitat Screening Levels

Contaminant	Ground Water Cleanup Objective[1]	Vapor Intrusion Residential Land Use High Permeability Vadose Zone Soil[2]	Aquatic Habitat Screening Level[3]
	(ug/L)	(ug/L)	(ug/L)
Benzene	1	541	46
Chlorobenzene	50	13302	25
Chloroethane	12	818	12
Chloroform	70	332	620
Dichlorobenzene, 1,2-	10	77131	14
Dichloroethane, 1,1-	5	1017	47
Dichloroethane, 1,2-	0.5	204	10000
Dichloroethene, 1,1-	6	6282	25
Dichloroethene, cis-1,2-	6	6163	590
Dichloroethene, trans-1,2-	10	6700	590
Dichloropropene, 1,1-	NA	NA	NA
Ethylbenzene	30	169000	290
Freon 113	59000*	NA	NA
Isopropyl benzene	NA	NA	NA
Methylene Chloride	5	NA	NA
MTBE	5	NA	NA
Tetrachloroethene (PCE)	5	125	120
Tetrahydrofuran	1.6*	NA	NA
Toluene	40	376977	130
Trichloroethane, 1,1,1-	200	127040	62
Trichloroethane, 1,1,2-	5	346	4700
Trichloroethene (TCE)	5	533	360
Trimethylbenzene, 1,2,4-	12*	NA	NA
Trimethylbenzene, 1,3,5-	12*	NA	NA
Vinyl Chloride	0.5	4	780
Xylenes (Total)	20	161000	100

1 - "Screening for Environmental Concerns at Sites with Contaminated Soil and Groundwater, California Regional Water Quality Control Board, San Francisco Bay, Interim Final, February 2005" (Environmental Screening Levels), Table F-1a, Ceiling Value (Taste & Odor) and Drinking Water (Toxicity)
2 – See 1 above, Table E-1a
3 -See 1 above, Table F-1a
4 - US EPA Preliminary Remediation Goals (PRGs) - October 2004
ug/L - micrograms per liter
ug/m^3 - micrograms per cubic meter
NA -Not Available

Table B-2. Volatile Organic Compounds (VOCs) in Ground Water at Romic Facility

Compound	Site Average (ug/L)	Zone	Maximum (ug/L)	Maximum Location
benzene		A	1,000	RP-8A
benzene	58	B	580	RW-20B
benzene		C	89	RW-19C
chlorobenzene		A	3,100	RW-28A
chlorobenzene	199	B	590	RW-19B
chlorobenzene		C	1,400	RW-19C
chloroethane		A	7,800	RW-2A
chloroethane	119	B	92	RW-19B
chloroethane		C	160	RW-8C
chloroform		A	1,200	RW-8A
chloroform	469	B	2,500	EW-2B
chloroform		C	170	RW-19C
1,2-dichlorobenzene		A	1,100	RP-10A
1,2-dichlorobenzene	42	B	420	RW-19B
1,2-dichlorobenzene		C	150	RW-5C
1,1-dichloroethane		A	7,400	RW-28A
1,1-dichloroethane	233	B	1,900	EW-2B
1,1-dichloroethane		C	4,800	RW-19C
1,2-dichloroethane		A	78,000	RW-28A
1,2-dichloroethane	4064	B	50,000	RP-15B
1,2-dichloroethane		C	67,000	RW-19C
1,1-dichloroethene		A	12,000	RW-28A
1,1-dichloroethene	563	B	7,100	RP-15B
1,1-dichloroethene		C	910	RW-19C
cis-1,2-dichloroethene		A	210,000	RW-28A
cis-1,2-dichloroethene	5548	B	89,000	EW-1B
cis-1,2-dichloroethene		C	86,000	RW-19C
trans-1,2-dichloroethene		A	4,000	RW-28A
trans-1,2-dichloroethene	104	B	4,420	EW-1B
trans-1,2-dichloroethene		C	1,100	RW-19C
ethylbenzene		A	4,500	RW-28A
ethylbenzene	277	B	1,700	EW-2B
ethylbenzene		C	3,400	RW-19C
isopropylbenzene		A	66	RW-4A
isopropylbenzene	9	B	30	EW-2B
isopropylbenzene		C	36	RW-19C
tetrachloroethylene (PCE)		A	13,000	RW-28A
tetrachloroethylene (PCE)	703	B	3,700	RW-20B
tetrachloroethylene (PCE)		C	10,000	RW-19C
toluene		A	36,000	RW-28A
toluene	1008	B	5,100	EW-2B
toluene		C	27,000	RW-19C
1,1,1-tetrachloroethane		A	140	RW-10A

Table B-2. Volatile Organic Compounds (VOCs) in Ground Water at Romic Facility

Compound	Site Average (ug/L)	Zone	Maximum (ug/L)	Maximum Location
1,1,1-tetrachloroethane	569	B	10,000	RW-20B
1,1,1-tetrachloroethane		C	850	RW-19C
1,1,2-tetrachloroethane	1223	A	10,000	RW-28A
1,1,2-tetrachloroethane		B	11,000	RP-15B
1,1,2-tetrachloroethane		C	15,000	RW-17C
trichloroethene (TCE)	2613	A	54,000	RW-28A
trichloroethene (TCE)		B	86,000	RP-15B
trichloroethene (TCE)		C	250,000	RW-17C
1,2,4-trimethylbenzene	77	A	710	RW-11A
1,2,4-trimethylbenzene		B	350	EW-2B
1,2,4-trimethylbenzene		C	440	RW-18C
1,3,5-trimethylbenzene	38	A	290	RW-11A
1,3,5-trimethylbenzene		B	94	EW-1B
1,3,5-trimethylbenzene		C	140	RW-18C
vinyl chloride	3417	A	210,000	RW-28A
vinyl chloride		B	34,000	RW-5B
vinyl chloride		C	59,000	RW-19C
total xylenes	853	A	21,800	RW-28A
total xylenes		B	4,200	RW-20B
total xylenes		C	10,500	RW-19C
Freon 113	1298	A	7,600	RW-1A
Freon 113		B	8,800	EW-2B
Freon 113		C	3,800	RW-18C
methylene chloride	7	A	18,000	RW-28A
methylene chloride		B	1,600	EW-2B
methylene chloride		C	18,000	RW-19C
MTBE	18	A	140	RW-3A
MTBE		B	6	RP-15B
MTBE		C	5	RW-8C

Data Source: Draft Corrective Measures Study, Romic Environmental Technologies Corporation, Arcadis U.S., Inc, 14 June 2007

Data from 2000-2007

Average values do not include non-detects

Averages are by contaminant, not by zone

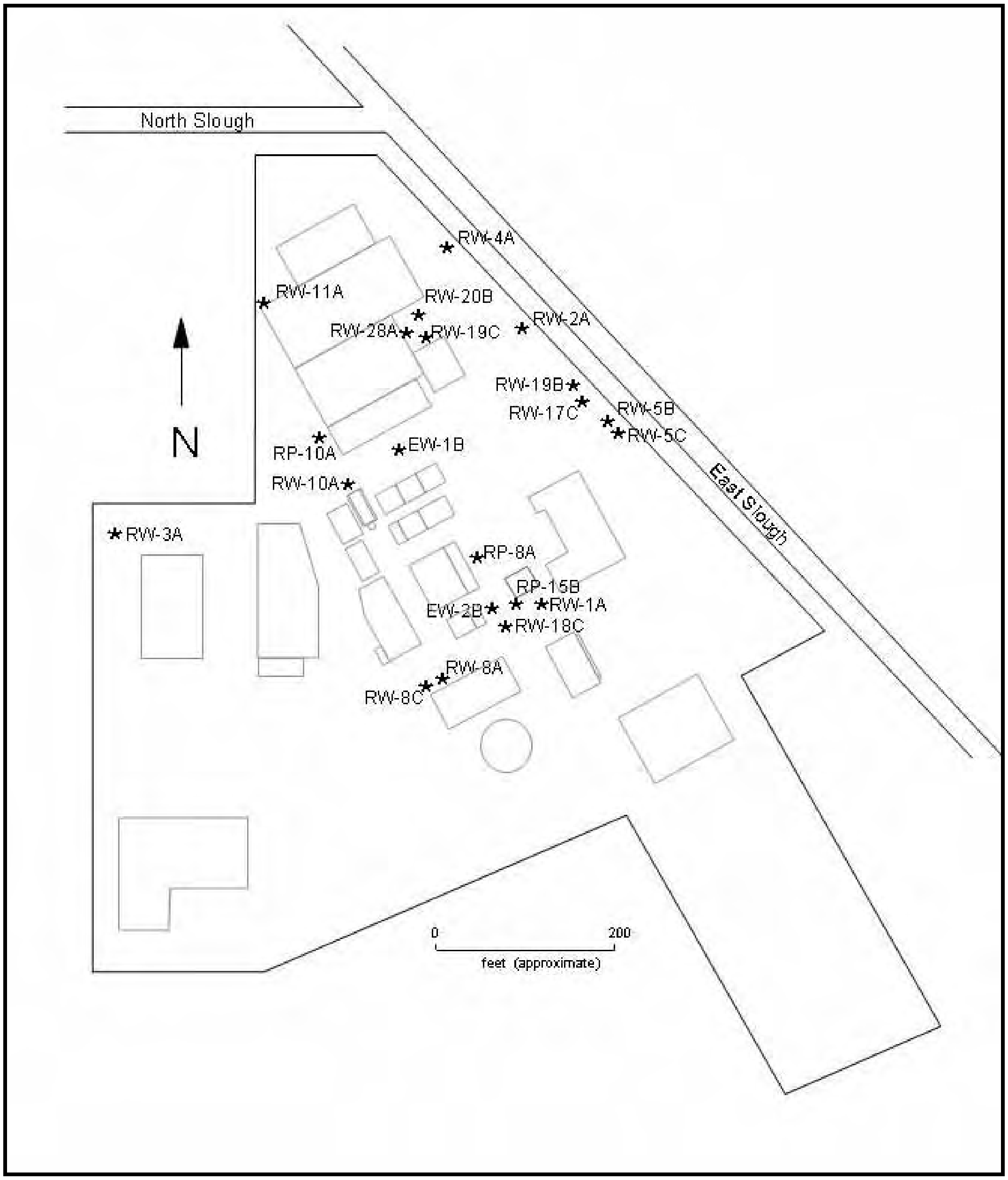

Figure 6. Wells Listed in Table B-2

Table B-3. Romic Environmental Technologies Corporation

Surface Water Analytical Results for Northern and Eastern Sloughs

Sampling Location	Date Sample Collected	Chloro benzene (µg/L)	1,2-Dichloro benzene (µg/L)	1,1-DCA (µg/L)	1,2-DCA (µg/L)	1,1-DCE (µg/L)	cis-1,2-DCE (µg/L)	trans-1,2-DCE (µg/L)	Ethyl benzene (µg/L)	Toluene (µg/L)	TCE (µg/L)	1,2,4-Trimethyl benzene (µg/L)	1,3,5-Trimethyl benzene (µg/L)	Vinyl Chloride (µg/L)	MTBE (µg/L)
S-2	6-Dec-00	<2.0	<2.0	2.67	3	<2.0	14.4	<2.0	<2.0	**2.77**	<2.0	<2.0	<2.0	**66**	NA
S-4	6-Dec-00	<2.0	<2.0	<2.0	<2.0	<2.0	**4.07**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**13**	NA
S-10	15-Jun-01	<2.0	<2.0	<2.0	<2.0	<2.0	**2.00**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NA
S-2	15-Jun-01	<2.0	<2.0	<2.0	**22**	<2.0	**27**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**45**	NA
S-4	15-Jun-01	<2.0	<2.0	<2.0	**8**	<2.0	**8.8**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**15**	NA
S-7	15-Jun-01	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**3**	NA
S-4	18-Dec-01	<2.0	<2.0	**2.4**	**22**	<2.0	**35**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**44**	NA
S-2	4-Apr-02	<2.0	<2.0	<2.0	**9**	<2.0	**13**	<2.0	<2.0	**2.2**	<2.0	<2.0	<2.0	**28**	NA
S-1	5-Apr-02	<2.0	<2.0	**3.1**	**49**	**2.6**	**53**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**43**	NA
S-4	5-Apr-02	<2.0	<2.0	<2.0	**22**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	NA
S-4	12-Jun-02	<2.0	<2.0	<2.0	**10**	<2.0	**14**	<2.0	<2.0	<2.0	<2.0	<2.0	<2.0	**17**	NA
S-10	25-Sep-02	<0.50	<0.50	<0.50	<0.50	<0.50	**0.54**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.77**	NA
S-2	25-Sep-02	<0.50	<0.50	<0.50	**0.54**	<0.50	**0.84**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**1.5**	NA
S-4	25-Sep-02	<0.50	<0.50	**0.64**	**3.8**	<0.50	**5.5**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**14**	NA
S-10	3-Jan-03	**0.82**	<0.50	**2.0**	**24**	**1.5**	**28**	**0.67**	**0.55**	**2.5**	**1.6**	<0.50	<0.50	**35**	**5.8**
S-2	3-Jan-03	<0.50	<0.50	<0.50	**4.8**	<0.50	**5.1**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**6.0**	**0.98**
S-7	3-Jan-03	**0.86**	<0.50	**2.2**	**25**	**1.6**	**30**	**0.69**	**0.57**	**2.7**	**1.7**	<0.50	<0.50	**39**	**7.5**
S-10	7-Feb-03	<0.50	<0.50	**0.60**	**6.9**	<0.50	**9.0**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**11**	<0.50
S-10	12-Mar-03	<0.50	<0.50	<0.50	**1.6**	<0.50	**2.8**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**3.4**	<0.50
S-2	12-Mar-03	<0.50	<0.50	<0.50	<0.50	<0.50	**0.67**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.97**	<0.50
S-7	12-Mar-03	<0.50	<0.50	<0.50	**3.8**	<0.50	**6.1**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**7.4**	<0.50
S-10	18-Jun-03	<0.50	<0.50	<0.50	<0.50	<0.50	**0.58**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50
S-2	18-Jun-03	<0.50	<0.50	<0.50	<0.50	<0.50	**0.98**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.76**	<0.50
S-4	18-Jun-03	<0.50	<0.50	**1.0**	**6.0**	**0.59**	**12**	<0.50	<0.50	**0.62**	**1.0**	<0.50	<0.50	**16**	**0.57**
S-10	18-Sep-03	<0.50	<0.50	**0.86**	**4.0**	<0.50	**8.80**	<0.50	<0.50	**0.68**	<0.50	<0.50	<0.50	**13**	**0.73**
S-2	18-Sep-03	<0.50	<0.50	<0.50	<0.50	<0.50	**0.68**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**1.10**	<0.50

Table B-3. Romic Environmental Technologies Corporation

Surface Water Analytical Results for Northern and Eastern Sloughs

S-4	18-Sep-03	<0.50	<0.50	**1.0**	**6.0**	**0.59**	**0.80**	<0.50	<0.50	**0.62**	**1.0**	<0.50	<0.50	**1.8**	**0.57**
S-1	18-Mar-04	<0.50	<0.50	<0.50	**0.67**	<0.50	**1.0**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**1.3**	NA
S-2	18-Mar-04	<0.50	<0.50	<0.50	**1.2**	<0.50	**3.2**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**7.2**	<0.50
S-4	18-Mar-04	<0.50	<0.50	<0.50	**3.1**	<0.50	**5.2**	<0.50	<0.50	**0.76**	<0.50	<0.50	<0.50	**8.8**	<0.50
S-10	22-Jun-04	<0.50	<0.50	<0.50	<0.50	<0.50	**0.68**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.82**	<0.50
S-2	22-Jun-04	**0.69**	<0.50	**0.68**	**1.4**	<0.50	**5.7**	<0.50	<0.50	**0.59**	<0.50	<0.50	<0.50	**15**	<0.50
S-2	30-Sep-04	<2.5	<2.5	<2.5	<2.5	<2.5	**2.6**	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	**13**	<2.5
S-4	30-Sep-04	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	**3.3**	<2.5
S-10	29-Mar-05	<0.50	<0.50	<0.50	**1.9**	<0.50	**2.9**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**2.1**	<0.50
S-2	29-Mar-05	<2.5	<2.5	<2.5	**3.7**	<2.5	**6.9**	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	**11**	<2.5
S-4	29-Mar-05	<2.5	<2.5	**2.9**	**21**	<2.5	**46**	<2.5	<2.5	<2.5	<2.5	<2.5	<2.5	**54**	<2.5
S-10	9-Jun-05	<0.50	<0.50	<0.50	**0.57**	<0.50	**1.2**	<0.50	<0.50	<0.50	<0.50	<0.50	<0.50	**0.69**	NA
S-2	9-Jun-05	**1.4**	<0.50	**0.78**	**1.9**	<0.50	**5.4**	<0.50	<0.50	0.71	<0.50	<0.50	<0.50	**12**	NA
S-4	9-Jun-05	**0.70**	<0.50	**2.0**	**11**	1.5	**28**	**0.79**	<0.50	**1.3**	**0.88**	<0.50	<0.50	**29**	NA
S-10	16-Aug-05	<0.5	<0.5	<0.5	**0.6**	<0.5	**1.3**	<0.5	<0.5	<0..5	<0.5	<0.5	<0.5	**1.3**	<0..5
S-2	16-Aug-05	<0.5	<0.5	<0.5	**1.3**	<0.5	**3.1**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**4.3**	<0.5
S-10	22-Mar-06	<0.5	<0.5	<0.5	**2.3**	<0.5	**4.2**	<0.5	<0.5	<0..5	<0.5	<0.5	<0.5	**4.2**	<0..5
S-2	23-Mar-06	**1.4**	<0.5	5.0	**34**	**4.2**	**75**	**1.6**	**0.9**	**3.3**	**2.4**	<0.5	<0.5	**92**	**0.6**
S-4	23-Mar-06	<0.5	<0.5	<0.5	**1.3**	<0.5	**2.7**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**3.3**	<0.5
S-10	14-Jun-06	<0.5	<0.5	<0.5	<0..5	<0.5	<0..5	<0.5	<0.5	<0..5	<0.5	<0.5	<0.5	**0.52**	<0.5
S-2	14-Jun-06	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.59**	<0.5
S-4	14-Jun-06	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**0.53**	<0.5
S-10	22-Sep-06	<0.5	**5.4**	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	**550**	**54**	<0..5	<0.5
S-10	13-Mar-07	<0.5	<0.5	**2.2**	**10**	**1.1**	**21**	**0.68**	<0.5	**0.72**	**0.65**	<0.5	<0.5	**41**	**0.51**
S-2	13-Mar-07	<0.5	<0.5	**2.2**	**10**	<0.5	**21**	**0.61**	<0.5	**0.79**	**0.62**	<0.5	<0.5	**39**	**0.53**
S-4	13-Mar-07	<0.	<0.5	**2.00**	**9.7**	**0.81**	**18**	**0.53**	<0.5	**0.61**	**0.55**	<0.5	<0.5	**32**	**0.51**
S-7	13-Mar-07	<0.5	<0.5	**2.1**	**10**	**0.92**	**20**	**0.63**	<0.5	**0.70**	**0.58**	<0.5	<0.5	**36**	<0.5

Note: **Bold face** results are detected concentrations. Samples with "<" are non-detect for the indicated compound; the associated numerical value is the laboratory quantitation limit

Surface water samples are analyzed for 26 VOCs. Only the 14 VOCs detected are listed in this table.