Intel Santa Clara 3 Superfund Site

U.S. Environmental Protection Agency • Region 9 • San Francisco, CA • April 2010

EPA Seeks Public Comment on Proposed Plan to Change Groundwater Remedy

Introduction

This fact sheet presents the cleanup plan proposed by the U.S. Environmental Protection Agency (EPA) to address contaminated groundwater at the Intel Santa Clara 3 Superfund Site in Santa Clara, California. This plan proposes to replace the original remedy chosen in 1990, a **groundwater pump and treat system**, which was turned off in 1994 when the Regional Water Quality Control Board (Water Board) determined that the system was no longer effective.

EPA proposes using Monitored Natural Attenuation (MNA) to address the remaining low levels of contaminants in the groundwater. MNA involves letting naturally-occurring physical, chemical, and/or biological processes reduce the amount of contaminants in groundwater. EPA's proposed remedy also includes long-term monitoring and land-use restrictions to prevent human and ecological exposure to contamination and to ensure that the contaminated groundwater does not spread.

This plan describes the past cleanup history at the Site as well as the remaining contamination. In addition to discussing EPA's preferred action, this plan presents EPA's cleanup goals and the effectiveness cost, and feasibility of several other cleanup alternatives. EPA seeks your feedback on this proposed cleanup plan. Your comments and suggestions may result in changes to the plan. After EPA reviews all public comments on the plan and on related documents, we will adopt and implement a final cleanup plan.

Community Participation

EPA invites your comments on this proposed plan and is accepting comments from **May 5 to June 4** by email, fax or mail. EPA will also be holding a public meeting at the Santa Clara Public Library on May 19, 2010 from 6:30-8:30 PM. During this meeting EPA will explain the Agency's plan for cleaning up the residual groundwater contamination and will accept written and oral comments.

Public Meeting

May 19, 2010
6:30-8:30 PM

Santa Clara Public Library
2635 Homestead Road, Santa Clara, CA

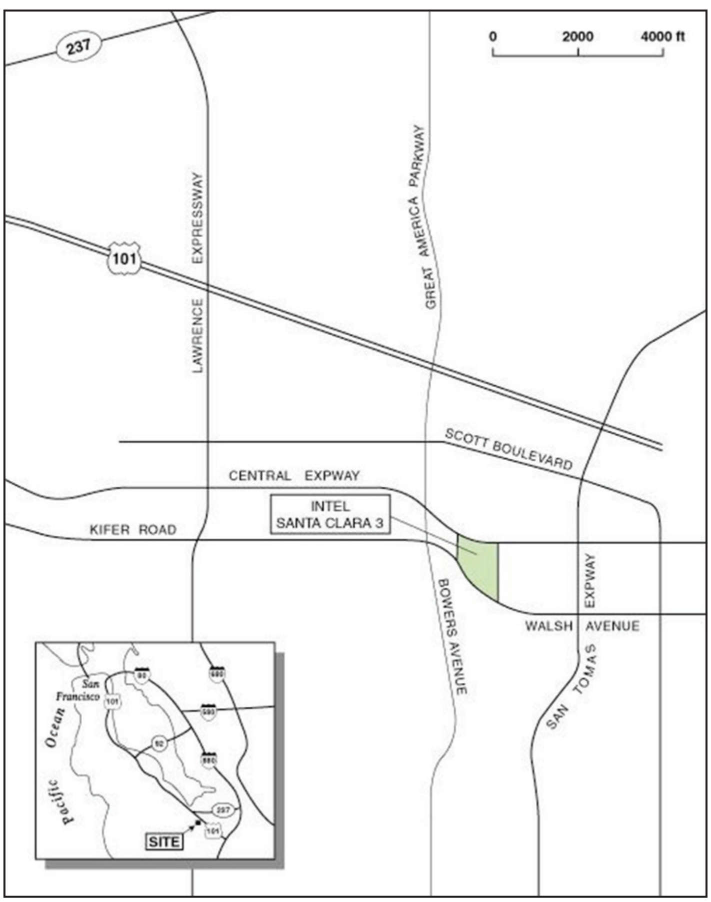

Figure 1: Intel Santa Clara 3 Site (EPA# CAT000612184)

Site Background

The Intel Santa Clara 3 Site (Site) is located at 2880 Northwestern Parkway in the city of Santa Clara, California (Figure 1). The groundwater beneath the Site is contaminated with **volatile organic compounds (VOCs)**, including **trichloroethylene (TCE)** which is a solvent. Other VOCs were initially detected in the 1980s, but TCE is the only contaminant that remains at concentrations above cleanup standards.

This Proposed Plan is being issued pursuant to CERCLA §117(a) and the National Contingency Plan §300.430(f)(2).

The buildings at the Site were constructed in 1975 by Intel and were used from 1976 to 2008 for performing quality control of chemicals and electrical testing of semiconductors. The source of contamination was never definitively identified, but was most likely leakage from an acid neutralization system. Groundwater contamination was first discovered at the Site in 1982, when groundwater samples were collected as part of a leak detection program for underground tanks in the Bay Area initiated by the Water Board.

Following the discovery of groundwater contamination at the Site, two groundwater extraction wells were installed in 1985 to remove contaminated groundwater. The Site was added to the **National Priorities List** in 1986, but the state Water Board remained the lead agency at the Site. The selected remedy for the Site, documented in the 1990 Record of Decision, was pumping the contaminated groundwater and treating it with activated carbon to remove contaminants before discharging to a storm drain. The remedy also included installation of an additional extraction well, groundwater monitoring, and the recording of a land use covenant prohibiting the use of shallow groundwater. The original decision and the documents underlying it are available as part of the Administrative Record, which is a collection of site documents that form the basis for EPA's selection of a remedy (see page 9 for location information).

Between 1985 and 1994, approximately 45 million gallons of groundwater were extracted and treated, removing approximately 28 pounds of TCE. Most contaminant mass was removed in the first few years of operation of the groundwater treatment system (Figure 2). In 1994 the Water Board approved turning off the groundwater pump and treat system. EPA assumed oversight of the Intel Santa Clara 3 Site in 2006.

Site Characteristics

The Site is approximately one acre in size, and consists of a low-rise building, and landscaping and parking areas (Figure 3). The City of Santa Clara has about 95,200 residents, and is part of the San Francisco Bay Metropolitan Region, which has a population of about six million. The Site is located in a light industrial and commercial area dominated by the electronics industry. Most buildings in the area are low rise developments containing office space and research and development facilities. The nearest residential area is about 2,000 feet south and is upgradient of the Site with respect to groundwater flow direction.

The Site is located in the Santa Clara Valley, which has complex geology. Groundwater generally flows northeast towards the San Francisco Bay. Municipal water supply wells tap an extensive deep regional **aquifer** about 200 to 300 feet below ground surface. The nearest municipal water supply well

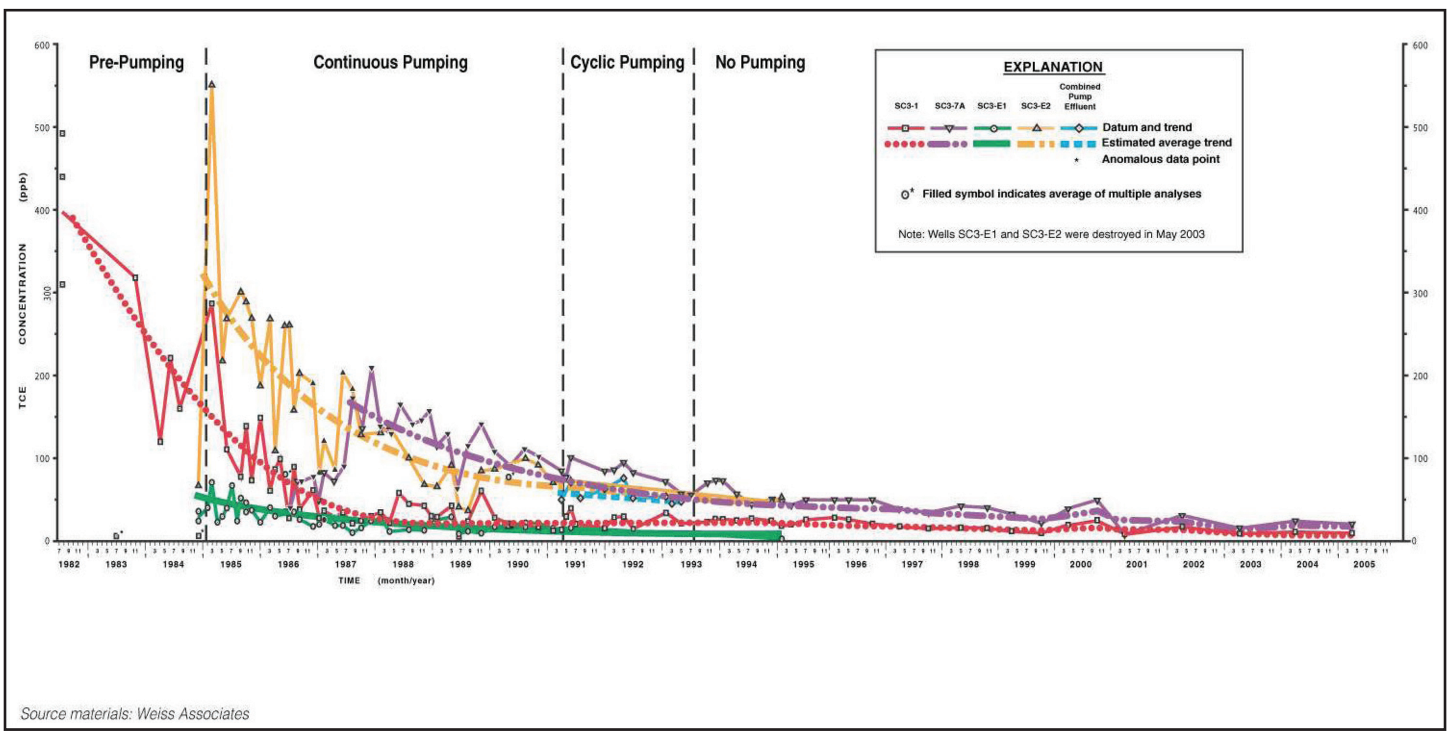

Figure 2: TCE concentrations in groundwater over time

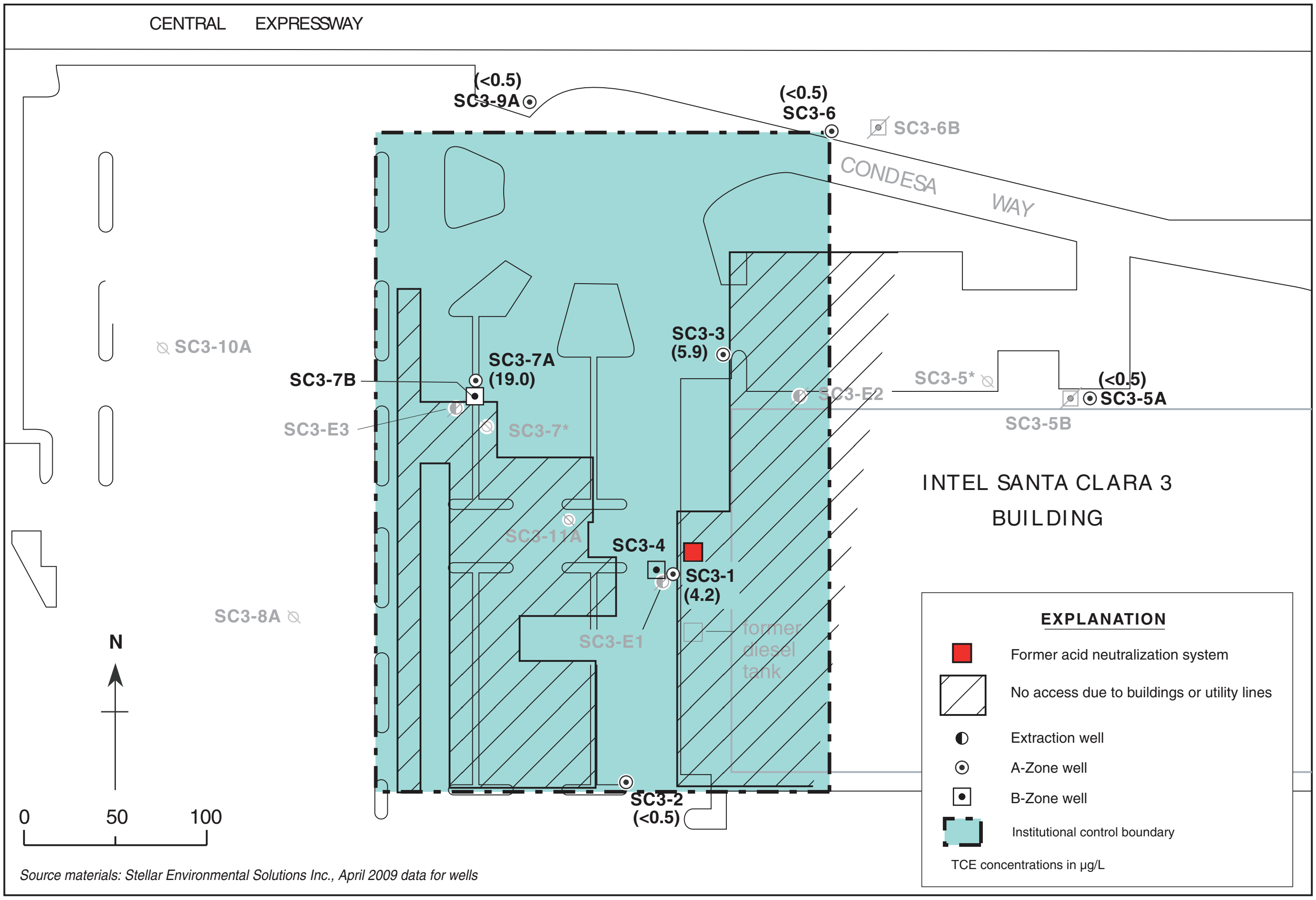

Figure 3: Site map with 2009 groundwater monitoring results (TCE concentrations in parentheses) and Institutional Control boundary

downgradient of the Site is a City of Santa Clara well located 1.6 miles north of the Site. A thick clay layer separates this aquifer from several discontinuous shallow aquifers above it. At the Intel Site, the shallowest aquifer is about 10 to 25 feet below ground surface, and the next shallowest is about 30 to 45 feet below ground surface. The contaminated plume is about 300 feet by 150 feet in size, is not spreading, and is confined to the shallowest aquifer (Figure 3). No TCE has been detected in the deeper aquifers at the Site.

Scope and Role of Response Action

The proposed remedy would replace part of the existing remedy, which was a groundwater extraction and treatment system that was turned off in 1994. The proposed remedy addresses the remaining TCE contamination that exceeds the federal drinking water standard of 5 micrograms per liter (µg/L).

Summary of Site Risks

There are no complete exposure pathways currently threatening human health or the environment at the Site. The reasonably anticipated future land use at the Site is light industrial, based on past activity at the Site and surrounding land use. A land use covenant recorded with the Santa Clara County Recorder's Office in 2008 prohibits residential and certain other land uses at the Site. The land use covenant also prohibits groundwater extraction and use or soil excavation without express permission from the Water Board.

The Site overlies the Santa Clara Valley groundwater basin, which provides up to 50% of the municipal drinking water for over 1.4 million residents of the Santa Clara Valley. However, the contamination at the Site has only affected the groundwater in the shallowest aquifer, which is not currently used for drinking. The most recent groundwater monitoring data, from 2009, indicated that three shallow wells had detectable TCE concentrations, of 19.0 µg/L, 5.9 µg/L, and

4.2 µg/L. Naturally occurring selenium and total dissolved solids make the shallow water unsuitable for drinking without treatment. The property is mostly paved, and potential impacts to surface waters are not a concern as there are no natural surface drainage features or surface water bodies at the Site. The nearest surface water body is San Tomas Aquino Creek, located ½ mile west of the site.

Vapor intrusion, where pollutants volatilize from the groundwater and migrate into the air inside nearby buildings, was also evaluated as a possible way for humans to be exposed to the contamination. Indoor air monitoring results from March 2010 did not detect the presence of any VOCs above the EPA Region 9 **Regional Screening Levels** (RSLs). The one detection of TCE at 1.8 µg/m^3 was below the RSL of 6.1 µg/m^3 for industrial indoor air, and the one detection of vinyl chloride at 0.076 µg/m^3 was below the RSL of 2.8 µg/m^3. The low concentrations of TCE in the groundwater and soil gas also indicate there is no significant risk from vapor intrusion at the Site.

In general, EPA also considers the potential risk to humans of exposure to VOC-impacted soil through dermal (skin) contact, ingestion (eating), and/or inhalation (breathing). In 1984, the only VOC detected in soil was TCE, at a maximum concentration of 0.048 milligrams per kilogram (mg/kg). This is well below the RSLs for direct exposure to TCE in soil of 2.8 mg/kg for residential use and 14 mg/kg for industrial use.

Contamination at the Site does not pose a risk to critical habitats or endangered species because there are no likely exposure pathways. The Site is located in an industrial area, and both the Site and nearby areas are mostly paved.

As summarized here, the risks currently posed by contamination at the Site are low and mostly controlled. However, the pump and treat remedy selected in 1990 is no longer functioning as intended, and the remedy must therefore be amended to accommodate conditions at the Site. It is EPA's current judgment that the Preferred Alternative identified in this Proposed Plan, or one of the other active measures considered in the Proposed Plan, is necessary to protect public health or welfare or the environment from actual or threatened releases of pollutants or contaminants from this site which may present an imminent and substantial endangerment to public health or welfare.

Remedial Action Objectives

The Remedial Action Objective for the Intel Santa Clara 3 Site is to reduce contaminant concentrations in the groundwater below the **maximum contaminant levels (MCLs**) for drinking water. This is the same goal established as part of the original remedy. TCE is the only contaminant at the Site that remains at levels above its MCL, which is 5 µg/L.

Summary of Remedial Alternatives

EPA has evaluated how well each of five cleanup alternatives satisfies the remedial action objectives and other requirements. Each alternative is described below, including EPA's preferred alternative (Alternative 5).

Alternative 1: No Action

EPA is required to consider the no action alternative. Under this alternative, the existing land use covenant would remain in place, no additional treatment would be implemented, and monitoring would cease.

Alternative 2: In-situ Enhanced Bioremediation

In-situ bioremediation relies on microorganisms, either naturally occurring or artificially introduced into the subsurface, to break down the organic contaminants to inert and less toxic by-products. Bioremediation can occur aerobically (in the presence of oxygen) or anaerobically (without oxygen), but aerobic bioremediation was screened out because of the difficulty of circulating methane, oxygen, and nutrients through the subsurface given the physical site constraints of buildings and utility lines. In the anaerobic process that was evaluated as an alternative for the Site, microorganisms utilize the injected compounds to chemically convert VOC's such as TCE to intermediate byproducts, and then eventually to non-toxic ethene. The amount of time required to achieve the MCL with this technology is uncertain, and may be a few years to a few decades. In-situ bioremediation is estimated to cost $120,000 in capital cost, with annual operation and maintenance costs of $15,000 for monitoring. The estimated present value cost of Alternative 2 is about $290,000.

Alternative 3: In-situ thermal desorption

In-situ thermal desorption (ISTD) heats the soil in the treatment zone to volatilize contaminants (turn liquid/dissolved TCE into a gas) so they can be collected with a **soil vapor extraction** system. Individual heating elements reach temperatures of 1,000-1,500°F, and are generally spaced 10 to 20 feet apart. The well field is designed such that the areas heated by each element overlap to maintain the minimum temperature required to volatilize the TCE throughout the target area. The system would operate for a few months to a year, followed by monitoring to determine effectiveness. Disadvantages of implementing ISTD at the site include interference with and endangerment of subsurface piping, as well as high energy cost. The capital cost for ISTD is estimated at $280,000, with $15,000 of annual monitoring costs for about 10 years. The present value cost of Alternative 3 is about $360,000.

Alternative 4: In-situ chemical oxidation

This alternative uses oxidation, which is a chemical reaction involving electron transfer, to chemically convert contaminants into non-hazardous or less toxic compounds that are more stable, less mobile, or non-reactive. Chemical oxidation breaks TCE down to carbon dioxide and water. In-situ oxidation would require the injection of oxidants (chemicals that induce the reaction), such as Fenton's Reagent, hydrogen peroxide, or permanganate, into the ground so that they can react with and destroy the contaminants in the groundwater. A pilot test of oxidant injection was conducted by Intel in 2006. TCE concentrations initially decreased, but rebounded and thus did not decrease below the MCL. Because multiple injections of oxidant will be required, the exact amount of time required to achieve the MCL with this technology is uncertain, but will be a few years to a few decades. In-situ chemical oxidation is estimated to cost $140,000, with annual operation and maintenance costs of $15,000 in monitoring. The present value cost of Alternative 4 is about $300,000.

Alternative 5: Monitored Natural Attenuation (EPA's Preferred Alternative)

Natural attenuation relies on naturally occurring physical, chemical, or biological processes that act without human intervention to reduce the mass, toxicity, mobility, volume, or concentration of contaminants in soil or groundwater. A study investigating the suitability of natural attenuation for

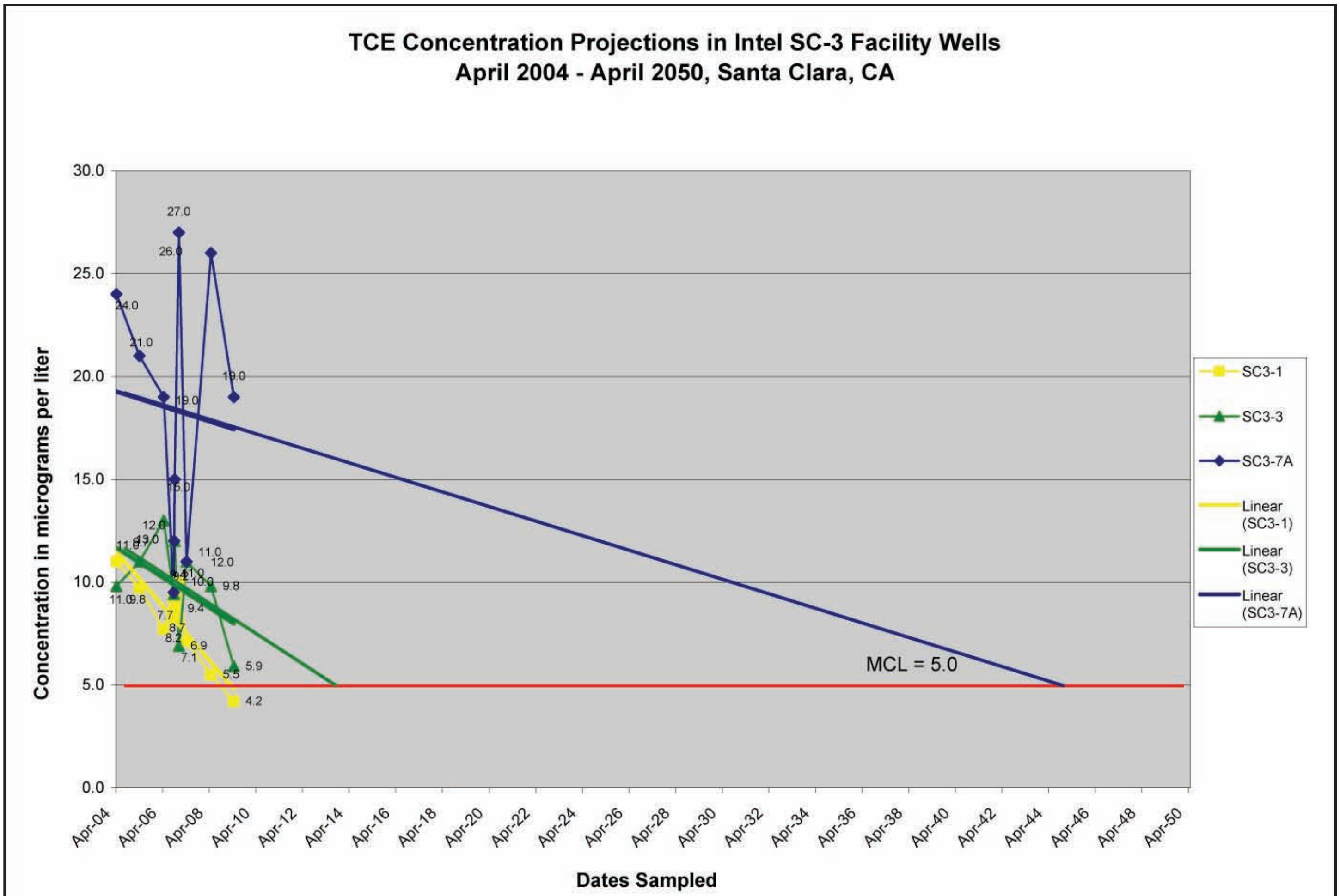

Figure 4: Example prediction of approximate time to reach the TCE MCL based on the last five years of monitoring data. Depending upon the model and data set used, estimates range from a few years to several decades, so an exact prediction of the time required to reach the MCL in all wells is not possible.

the Site was conducted in 2009. Lines of evidence show that TCE concentrations are decreasing through physical, although not biological, processes. Based on the most recent five years of monitoring data, the two remaining wells with TCE concentrations above the MCL are projected to take 5 to 35 years to reach the MCL (Figure 4). Depending upon the model and data set used, estimates range from a few years to several decades, so an exact prediction of the time required to reach the MCL in all wells is not possible. There is no capital cost associated with MNA, but the monitoring costs of about $20,000 a year add up to a present value cost of about $230,000.

Evaluation of Alternatives

EPA evaluates each of the alternatives based on nine standard criteria. The two threshold criteria are the most important: overall protection of human health and the environment, and compliance with federal and state "applicable or relevant and appropriate requirements" (ARARs). Balancing criteria include long-term effectiveness and permanence; reductions in toxicity, mobility, and volume through treatment; short-term effectiveness; implementability and cost. Modifying criteria are state and community acceptance, which will be evaluated after the close of the public comment period. Figure 5 illustrates how each alternative compares to the nine criteria.

Figure 5: Nine Criteria Analysis (excluding State and Community Acceptance)

Evaluation Criteria	Alternative 1 No Action	Alternative 2 In-situ Bioremediation	Alternative 3 In-situ Thermal Desorption	Alternative 4 In-Situ Chemical Oxidation	Alternative 5 Monitored Natural Attenuation
Overall Protectiveness of Human Health and the Environment	●	●	●	●	●
Compliance with ARARs	○	●	●	●	●
Long-term Effectiveness and Permanence	—	◒	●	◒	●
Reduction of Toxicity, Mobility, or Volume through Treatment	—	●	●	●	○
Short-term Effectiveness	—	◒	◒	◒	●
Implementability	—	◒	○	◒	●
Capital Cost	—	$120,000	$280,000	$140,000	$0
Annual O&M Cost	—	$15,000	$15,000	$15,000	$20,000
Present Value Cost[1]	—	$290,000	$360,000	$300,000	$230,000

[1]Present Value Cost estimated over 30 years at 7% discount rate

○ = Does not meet criterion ◒ = Partially meets criterion ● = Meets criterion

Threshold Criteria

Overall protection of human health and the environment

All of the alternatives will be protective of human health and the environment. The plume is not migrating, and there are no exposure pathways that might harm environmental receptors. Alternatives 2-5 will reduce TCE concentrations in the groundwater to below the MCL, which is considered protective of human health. The land use covenant already in place that restricts soil excavation and groundwater use currently prevents exposure to the TCE contamination in the groundwater.

Compliance with ARARs

ARARs can be chemical specific, action specific, or location specific. The MCL for TCE of 5 µg/L is a relevant and appropriate chemical-specific requirement. Alternative 1 does not comply with ARARs because it would leave concentrations of TCE at the Site above the MCL. Because Alternative 1 does not meet this threshold criterion, it was not analyzed further. Alternatives 2-5 will reduce the TCE concentrations below the MCL, and will thus comply with ARARs.

Balancing Criteria

Long-term effectiveness and permanence

The remediation achieved by Alternatives 2-5 would be permanent. Successful implementation of any of these alternatives would clean up the groundwater to drinking water standards, and continued monitoring would ensure that the reduction in concentrations is not temporary. The land use covenant already recorded for the Site restricts soil disturbance and groundwater use at the Site, which further assures permanent long-term protectiveness. In terms of long-term effectiveness, however, Alternative 4 would likely require multiple iterations of oxidant injection to achieve MCLs, since the contaminant is tightly bound to the soil. It is uncertain whether even multiple injections would reduce concentrations below MCL's, so natural attenuation might be required, in addition to in-situ chemical oxidation to achieve remedial action objectives. Therefore, the long-term effectiveness of this technology alone is uncertain. Similarly, the long-term effectiveness of Alternative 2 is uncertain because the lack of naturally occurring biological degradation indicates that conditions may be unsuitable for bioremediation. Furthermore, the pathway from TCE to harmless byproducts sometimes stalls at intermediate byproducts, and so once the TCE concentration is reduced, other contaminants could then require additional remediation. Alternatives 3 and 5 are expected to be effective in the long-term without the use of additional technologies.

Reduction in toxicity, mobility, or volume through treatment

Alternative 2 generates intermediate byproducts that are more toxic than TCE, such as vinyl chloride, but the end products of complete bioremediation will be nontoxic, so Alternative 2 reduces toxicity through treatment. Alternative 3 would remove TCE from the groundwater and then treat the collected TCE vapors at the surface, satisfying the preference for treatment. Similarly, Alternative 4 would satisfy the preference for treatment by destroying TCE using chemical oxidation and converting it into benign byproducts, such as carbon dioxide and water. Alternative 5 is not an active treatment for the purposes of this criterion, and thus ranks lower than other alternatives, but most of the contaminant mass was already removed and treated as part of the original remedy for the Site.

Short-term effectiveness

One aspect of short-term effectiveness is protection of community and workers during implementation of the remedy. Alternatives 2, 3, and 4 all pose some risk to the workers implementing the remedy, due to the presence of high temperatures, heavy machinery, and/or strong chemicals. However, by following health and safety protocols these risks can be managed. Alternative 5, monitored natural attenuation, poses the least risk to workers or the community during implementation. Another aspect of short-term effectiveness is the amount of time required to achieve the remediation goals. Alternative 3 would take the least time relative to the other technologies. The time required to achieve remediation goals is more uncertain for Alternatives 2, 4, and 5, and so this aspect of the short-term effectiveness criterion is not a strong distinguishing factor between these alternatives.

Implementability

Alternative 3 has low technical feasibility due to interference with subsurface gas and electric utility lines at the Site. Additionally, the high temperatures generated by the technology are incompatible with the PVC monitoring wells onsite, which would have to be replaced. Therefore, Alternative 3 has very low implementability. Alternative 2 has moderate implementability, due to the difficulty of sustaining biological reactions with low levels of contaminants, and because biological degradation does not appear to be naturally occurring at the Site. There are also challenges associated with evenly distributing the compounds designed to enhance bioremediation throughout the subsurface, due to the clay properties of the soil and obstructions from utility lines and buildings.

Alternative 4 has similar challenges related to getting the injected chemicals in contact with the contaminants to create the oxidation reaction. Alternative 5 is the most implementable at the site, since additional subsurface structures are not needed.

Cost

EPA compares each alternative based on upfront capital cost, annual operation and maintenance cost, and overall present value cost, which is a measure of the total future project cost over a 30 year timeframe. Alternatives 2, 3 and 4 have significant upfront costs because of the onsite work required. Alternative 3 has the highest capital cost of $280,000, followed by Alternative 4 at $140,000, and Alternative 2 at $120,000. Alternative 5 has no upfront capital cost. Operation and maintenance costs for all the alternatives are similar, because the main annual expense is monitoring. Alternative 5 has a slightly higher operation and maintenance cost than the other alternatives, because monitoring for natural attenuation requires additional analyses beyond just TCE concentrations. In terms of present value costs, the most expensive technology is Alternative 3, estimated to cost $360,000. The next most expensive alternatives have very similar present value costs, of $300,000 for Alternative 4 and $290,000 for Alternative 2. Given the uncertainty in the number of injections and the amount of monitoring that will be required, these two costs are comparable. Alternative 5 is the cheapest, with an estimated present value cost of $230,000.

Modifying Criteria

State Acceptance

Staff of the Regional Water Quality Control Board, San Francisco Region, concur with EPA's proposed plan.

Community Acceptance

Community acceptance will be determined after the close of the public comment period. See the first page of this proposed plan for details about how to provide comments to the EPA.

Preferred Alternative

Based on information currently available, the EPA believes the Preferred Alternative meets the threshold criteria and provides the best balance of tradeoffs among the other alternatives with respect to the balancing and modifying criteria. The EPA expects the Preferred Alternative to satisfy the following statutory requirements of CERCLA §121(b): (1) be protective of human health and the environment; (2) comply with ARARs (or justify a waiver); (3) be cost-effective; (4) utilize permanent solutions and alternative treatment technologies or resource recovery technologies to the maximum extent practicable; and (5) satisfy the preference for treatment as a principal element, or explain why the preference for treatment will not be met.

EPA's preferred alternative is Alternative 5, Monitored Natural Attenuation, which will protect human health and the environment and achieve ARAR's. Though biological degradation does not appear to be occurring, other physical and chemical processes have been reducing contaminant concentrations since the pump and treat system was turned off. At Intel Santa Clara 3, the level of TCE in one of the three monitoring wells that still has detections of TCE is already below the MCL, and the remaining two wells with detectable TCE concentrations are gradually approaching the MCL of 5 µg/L. Though it may take several years or decades to reach the MCL, the alternative is still effective in the short term because there are no complete exposure pathways at the Site, the plume is not migrating, and the land use covenant currently in place prevents the groundwater from being accessed or used for any purpose. Even though Alternative 5 does not satisfy the preference for treatment, the original remedy already removed and treated most of the contaminant mass at the Site. Due to the low residual contaminant concentrations, the more active in-situ technologies would have significantly higher capital costs with limited value in risk reduction.

Glossary of terms

Aquifer: An underground geological formation, or group of formations, containing water

CERCLA: The Comprehensive Environmental Response Compensation and Liability Act is commonly known as the Superfund law, and provides Federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment.

Groundwater pump and treat: A system which physically extracts groundwater from the subsurface via wells and then treats it at the surface to remove contaminants. The original remedy for this Site involved pumping the groundwater and treating it with granular activated carbon to remove the chemicals

Maximum Contaminant Level (MCL): The maximum permissible level of a contaminant in water delivered to any user of a public drinking water system. MCLs are enforceable federal and state standards.

National Priorities List (NPL): The NPL is the list of national priorities among the known releases or threatened releases of hazardous substances, pollutants, or contaminants throughout the United States and its territories. The NPL is intended primarily to guide the EPA in determining which sites warrant further investigation.

National Contingency Plan (NCP): The NCP provides the guidelines and procedures needed to respond to releases and threatened releases of hazardous substances, pollutants, or contaminants. The NCP also established the NPL.

Regional Screening Levels (RSLs): RSLs (formerly known as Preliminary Remediation Goals) are risk-based contaminant levels that are considered by EPA to be protective of humans, and are used to identify areas, contaminants, and conditions that warrant further attention at a particular site.

Soil vapor extraction: A process by which gaseous chemicals, in this case TCE, are collected from the subsurface by applying a vacuum to draw out the vapors

Trichloroethylene (TCE): A stable, low boiling-point colorless liquid, which is toxic if inhaled. Used as a solvent or metal degreasing agent, and in other industrial applications

Vapor intrusion: Gas-phase migration of volatile organic and/or inorganic compounds into buildings from underlying contaminated ground water and/or soil

Volatile organic compounds (VOC): Carbon-containing chemicals that evaporate readily

Volatilization: The chemical transformation from a liquid to a gas

Mailing List Coupon

If you are not already on the Intel Santa Clara 3 Superfund Site mailing list and would like to be, please fill out the coupon below and return it to: Svetlana Zenkin, Community Involvement Coordinator, U.S. EPA, 75 Hawthorne St. (SFD-6-3), San Francisco, CA 94105 or e-mail the information to: zenkin.svetlana@epa.gov

Name ____________________

Mailing Address ____________________

City, State ____________________ Zip ____________

E-mail Address ____________________

Intel Santa Clara 3 Superfund Site

EPA Seeks Public Comment on Proposed Plan to Change Groundwater Remedy

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Site Repositories

The Administrative Record, which includes Site information and documents EPA used to create this proposed plan, is available at:

Santa Clara City Library
2635 Homestead Road Santa Clara, CA95051-5387
(408) 615-2900

Hours: Mon-Tues: 9:00 a.m -9:00 p.m.
Wed: 12:00 noon-9:00 p.m.
Thurs-Sat: 9:00 a.m-6:00 p.m.
Sun: 1:00 p.m.-5:00 p.m.

The most complete collection of documents is the official EPA site file, maintained at the following location:

Superfund Records Center
Mail Stop SFD-7C
95 Hawthorne Street, Room 403
San Francisco, CA 94105
(415) 536-2000

Enter main lobby of 75 Hawthorne street, go to 4th floor of South Wing Annex.

An index of the documents in the Administrative Record, and other site information, is available at EPA's website,
www.epa.gov/region09/intelsantaclara3

United States Environmental Protection Agency, Region 9
75 Hawthorne Street (SFD-6-3)
San Francisco, CA 94105
Attn: Svetlana Zenkin (Intel Santa Clara 4/10)

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