From: mei chen
To: Lew, Lisa (BOS)
Subject: Oppose 2550 Irving building project
Date: Monday, July 19, 2021 7:29:27 PM

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I’m oppose 2550 Irving building project!

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From: mei chen
To: Lew, Lisa (BOS)
Subject: Oppose 2550 Irving building project
Date: Monday, July 19, 2021 7:53:57 PM

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Hi my name is Mei, I live on 23rd Irving street, I am oppose 2550 Irving building project!!
Too high!
Always traffic problems on Irving street!!
Toxic spread to our neighborhood, it will effect our health and our children's health!!!!!!!
thank you
Get Outlook for iOS

From: Susan Tam
To: Lew, Lisa (BOS)
Subject: Resolution number #210763 oppose letter for 7/20/21 BOS meeting
Date: Monday, July 19, 2021 8:49:23 PM

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***** Oppose *****

I'm writing to oppose the plan to build a seven story, 100-unit low income housing project at 2550 Irving St. As a resident in the sunset neighborhood for 25+ years, I think this project is out of place and bad for the sunset district.

Our main concerns will be the increase in crime, burglaries, loitering, parking problems, increased homeless presence, loss of home value, noise, increases of trash, drug use, and many more. Please STOP this project immediately and please respect all the residents/homeowners in this neighborhood.

Thank you for your time and understanding.

Susan Tam
1270 25th Avenue
San Francisco, CA 94122

From: kanthu_lee@yahoo.com
To: Lane, Lisa (BOS)
Subject: Resolution number #210763 Oppose Letter for 7/20/21 BOS meeting
Date: Monday, July 19, 2021 10:47:11 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Hi Lisa,

I strong OPPOSE the housing project at 2550 Irivng.

Traffic along Lincoln Way is bad enough during peak hour in morning and evening. Residents in Sunset District cannot tolerate more vehicles in the 2500 Irving neighborhood.

Please take into consideration the feeling of local residents and stop this project.

Thx,
Kanthu Lee
1423 21st Ave
San Francisco, CA 94122

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From:	BOS Legislation, (BOS)
To:	Board of Supervisors, (BOS); Wong, Linda (BOS)
Cc:	BOS Legislation, (BOS)
Subject:	FW: Resolution number #210763 oppose letter for 7/20/21 BOS meeting
Date:	Tuesday, July 20, 2021 8:48:21 AM
Attachments:	image001.png

For File No. 210763.

Lisa Lew
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T 415-554-7718 | F 415-554-5163
lisa.lew@sfgov.org | www.sfbos.org

(VIRTUAL APPOINTMENTS) To schedule a "virtual" meeting with me (on Microsoft Teams), please ask and I can answer your questions in real time.
Due to the current COVID-19 health emergency and the Shelter in Place Order, the Office of the Clerk of the Board is working remotely while providing complete access to the legislative process and our services.

Click here to complete a Board of Supervisors Customer Service Satisfaction form

The Legislative Research Center provides 24-hour access to Board of Supervisors legislation, and archived matters since August 1998.

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From: Susan Tam <smjue@yahoo.com>
Sent: Monday, July 19, 2021 8:46 PM
To: BOS Legislation, (BOS) <bos.legislation@sfgov.org>
Subject: Resolution number #210763 oppose letter for 7/20/21 BOS meeting

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

***** Oppose *****

I'm writing to oppose the plan to build a seven story, 100-unit low income housing project at 2550 Irving St. As a resident in the sunset neighborhood for 25+ years, I think this project is out of place and bad for the sunset district.

Our main concerns will be the increase in crime, burglaries, loitering, parking problems, increased homeless presence, loss of home value, noise, increases of

trash, drug use, and many more. Please STOP this project immediately and please respect all the residents/homeowners in this neighborhood.

Thank you for your time and understanding.

Susan Tam
1270 25th Avenue
San Francisco, CA 94122

From: BOS Legislation, (BOS)
To: Board of Supervisors, (BOS); Wong, Linda (BOS)
Cc: BOS Legislation, (BOS)
Subject: FW: Resolution number #210763 Oppose Letter for 7/20/21 BOS meeting
Date: Tuesday, July 20, 2021 8:40:43 AM

For 210763.

Jocelyn Wong
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T: 415.554.7702 | F: 415.554.5163
jocelyn.wong@sfgov.org | www.sfbos.org

(VIRTUAL APPOINTMENTS) To schedule a "virtual" meeting with me (on Microsoft Teams), please ask and I can answer your questions in real time.

Due to the current COVID-19 health emergency and the Shelter in Place Order, the Office of the Clerk of the Board is working remotely while providing complete access to the legislative process and our services

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The Legislative Research Center provides 24-hour access to Board of Supervisors legislation, and archived matters since August 1998.

Disclosures: Personal information that is provided in communications to the Board of Supervisors is subject to disclosure under the California Public Records Act and the San Francisco Sunshine Ordinance. Personal information provided will not be redacted. Members of the public are not required to provide personal identifying information when they communicate with the Board of Supervisors and its committees. All written or oral communications that members of the public submit to the Clerk's Office regarding pending legislation or hearings will be made available to all members of the public for inspection and copying. The Clerk's Office does not redact any information from these submissions. This means that personal information—including names, phone numbers, addresses and similar information that a member of the public elects to submit to the Board and its committees—may appear on the Board of Supervisors' website or in other public documents that members of the public may inspect or copy.

-----Original Message-----
From: kambo_lee@juno.com <kambo_lee@juno.com>
Sent: Monday, July 19, 2021 10:43 PM
To: BOS Legislation, (BOS) <bos.legislation@sfgov.org>
Subject: Resolution number #210763 Oppose Letter for 7/20/21 BOS meeting

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

BOS Legislation,

I strong OPPOSE the housing project at 2550 Irivng.

Traffic along Lincoln Way is bad enough during peak hour in morning and evening. Residents in Sunset District cannot tolerate more vehicles in the 2500 Irving neighborhood.

Please take into consideration the feeling of local residents and stop this project.

Thx,
Kambo Lee
1423 21st Ave
San Francisco, CA 94122

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Here Are the 5 McCarthy Picks for Jan. 6 Committee https://avanan.url-protection.com/v1/url?o=http%3A//thirdpartyoffers.juno.com/TGL3131/60f662cf8e0dc62c8265aa01dac1&g=ZGNlZDdkZWVjZWUxYWQwYw==&h=MTY0MDM0ZjkxYTlmNmVhZjJmYmRkOWZmZDRkZGI3NWQwMzE0NjVlN2FmMjQ3YWI0ZmFjMjhmZmUxZDI0MjYxNQ==&p=YXAzOnNmZHQyOmF2YW5hbjpvOjAyZDZmYWFiZTM1YjBkMjhmY2JkMmFlNWFiMTU5ZjNiOnYx
Biden to Facebook: You're Not Killing People https://avanan.url-protection.com/v1/url?o=http%3A//thirdpartyoffers.juno.com/TGL3131/60f662cf8917b162c8265aa01dac2&g=ODhlYzcxZDhjNmJiMjhmMg==&h=M2VmMjVjNDU0NWU0ZjM0NDE0NzhkMGE0OTdlM2I3ZTJjOGM5MGM1MTEyNGNkYzQ2OTQ5Yn0#MGI2ZDE4MjYwMA==&p=YXAzOnNmZHQyOmF2YW5hbjpvOjAyZDZmYWFiZTM1YjBkMjhmY2JkMmFlNWFiMTU5ZjNiOnYx
Grad Charged After Hitler Quote Turns Up in Yearbook https://avanan.url-protection.com/v1/url?o=http%3A//thirdpartyoffers.juno.com/TGL3131/60f662cf8b692a62c8265aa01dac3&g=MGQwZmI1ZDc0MzgwYTc2MA==&h=ZDQ1MDgyYmM5MjhjZDJlYTIyMDBjYTU5ODE5ODI3NzZhOTZhNzA5OTNiYWYwM2NhYTEyZTBmZDVjNWU2YjkwMg==&p=YXAzOnNmZHQyOmF2YW5hbjpvOjAyZDZmYWFiZTM1YjBkMjhmY2JkMmFlNWFiMTU5ZjNiOnYx

From:	linda tang
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	Fw: Oppose The Approval of Loan For 2550 Irving
Date:	Monday, July 19, 2021 11:41:19 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors

I am a sunset resident who lives 31st Ave & Irving street and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I opposed the project as currently proposed

Our city and the sunset district need more affordable housing but as proposed, 2550 Irving Street is not the solution.

There are so many empty building in San Francisco, it is much easy to convert these business empty building to Affordable housing instead spending so munch money to build a new building.

Sincerely,

Linda
-

From:	Kelly Pan
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS)
Subject:	Resolution number# 210763 oppose letter for 07/20/21
Date:	Monday, July 19, 2021 11:39:14 PM

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Hello,

My name is Kelly Pan, and I am **oppose** to the 2550 Irving affordable housing development program.
Currently, Irving street is very crowded as is. There are many people jay walking, double parking, causing traffic jams, littering, and extremely hard to find parking.
If the affordable housing project is approved, then it will only add more and more problems to everything I mentioned above.

My address is 1867 34th Ave, San Francisco, CA 94122

Just wanted to voice my opinion.

thank you.
Kelly

From: MA Z
To: Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Cc: MA Z
Subject: Opposing 2550 Irving St Loan, 7/20/21 BOS meeting, File No. 210763
Date: Monday, July 19, 2021 11:27:59 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Supervisor Mar and Board of Supervisors:

I was born in San Francisco and reared in the Sunset, ALL my education was in the City. I attended nursery school, kindergarten, grammar school, high school, and university, all while living in the Sunset.
I have worked in the City and County of San Francisco for the last fifty (50) years. I am 'still' a resident in the Sunset and I **strongly oppose** the approval of the pre-development loan for 2550 Irving Affordable Housing development. Additionally, I **strongly oppose** the project *as currently proposed*.

-This building is not aligned w/the fabric of our neighborhood.
-This building directly impacts the existing residents of our neighborhood
-To impact our parking, which is already at a premium exemplifies just how much we, as constituents, have absolutely no say regarding the quality of our lives
-The Cost is greater than sixty (60) percent of the City's new Affordable Housing. How many bids were considered? How many Sunset residents were directly involved in the review?
-PCE vapors emitting, not remediated, endangering all residents, specifically those who will be housed in this seven (7) story building, i.e., expectant mothers, infants, children, elders, those w/medicalconditions. This is beyond irresponsible and knowingly inhumane.

There needs to be more studies of the potential harm emitting from the area/site; a greater, more creative, and informed 'think tank' on how to mitigate the construction of said building as well as the parking/traffic impact on 'our' neighborhood.

Above ALL else, I, a home owner, of the Sunset, need to be heard.

As w/all of us, I
-pay my mortgage
-shop in our neighborhood stores
-send my children and grandchildren, to our neighborhood schools
-volunteer to 'work' on projects such as our 'Sunset Blvd'
-plant trees for our neighborhood environment
and, and, and...

It is vital that you not only hear us, it is vital that you *listen*.

I urge you to not approve the pre-development loan, for
2550 Irving St.

District 4 Resident
Mary Anne Zamarripa, RN, PHN
3138 Moraga St
San Francisco, CA 94122

From: kambo_lee@yahoo.com
To: Wong, Linda (BOS)
Subject: Resolution number 4210763 Oppose Letter for 7/20/21 BOS meeting
Date: Monday, July 19, 2021 10:46:19 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Hi Linda,

I strong OPPOSE the housing project at 2550 Irving.

Traffic along Lincoln Way is bad enough during peak hour in morning and evening. Residents in Sunset District cannot tolerate more vehicles in the 2500 Irving neighborhood.

Please take into consideration the feeling of local residents and stop this project.

Thx,
Kambo Lee
1423 21st Ave
HSan Francisco, CA 94122

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From:	David Gasser
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Breed, Mayor London (MYR); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Cc:	terrilee
Subject:	Opposing 2550 Irving St. Loan, 7/20/21 BOS meeting, File No. 210763
Date:	Monday, July 19, 2021 10:34:48 PM
Attachments:	f033eb_072933c778b7498189f078745d01b8fa_mv2.webp

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Dear Supervisor Mar and the Board of Supervisors,

I and my wife are Sunset residents and we **OPPOSE** the approval of the pre-development loan for 2550 Irving Affordable Housing development and we **OPPOSE** the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are our concerns:

● TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
It should be right-sized to 4 stories.

● TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

● PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

● ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

● CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

● INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement. Attached is a picture to show how out of place the proposed building is compared to the rest of our community.

We urge you to listen to the D4 residents like us and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Residents,
David Gasser and Terri Lee
1342 26th Ave.


LOOKING EAST ON IRVING ST.

From:	Oleg Osipoff
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Peskin, Aaron (BOS)
Subject:	Resolution number #210763
Date:	Monday, July 19, 2021 10:32:39 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Sirs and Madams,
Thank you for viewing my note **Opposing** the Resolution number #210763.
Building a massive 7-story housing project right into this neighborhood will affect negatively the lives of every local resident forever for numerous reasons, and most, I'm sure you've heard. But for the sake of argument I can say that it's not affordable housing that is the problem here, most of us in the Sunset support it, but it's the people that are in charge of pushing the project through as it is, as quickly as possible regardless of the impact it has. It's understood that there is a financial incentive at play, and I think everyone can agree that money dictates in our society. It would be unfortunate if it does so in this critical decision to allow 2550 Irving to receive the City funds to start the building without full analysis and sensible reduction of those impacts. It must be the responsibility of our elected leaders to insure the proper mitigation of hazardous conditions that exist within the site. The sheer dimension and weight of a 7-story monolith will not hide the effects of toxic plume, but will surely expand it. It's unacceptable to allow the Police Credit Union to walk away from all responsibility for clean up and they should not be given the chance to do so. I urge you to think about the long term health of the community and vote for the safety and quality of life that you yourselves would expect and deserve as residents and taxpayers of San Francisco. Let's do affordable housing right - oppose resolution #210763.

Thank you,
Oleg Osipoff
1221 29th Ave.
City

From:	Katherine Fong
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	Oppose The Approval of Loan For 2550 Irving
Date:	Monday, July 19, 2021 10:16:02 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors

I am a sunset resident who live 8 blocks away and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I opposed the project as currently proposed

Our city and the sunset district need more affordable housing but as proposed, 2550 Irving Street is not the solution.

My main concern is the N line. There are 2 housing are by N Judah, one is at 3601 Lawton and one at 1360 43rd with 135 units which is low income housing for teachers. TDNC is trying to add another low income housing at 2550 Irving with 100 units and only 11 parking spaces. How is muni going to handle the increase of passengers who will use N during the rush hour.

Before the pandemic, I was already having problems with N no show. During the rush hour after work, I would be pushed into the N and being sardine with jam packed with passengers. I am short and have no place to hold on. At times, I can't even get on. How is muni going to handle additional 300 to 400 passengers? N is busier than L. Even Joel Ramos with Local Government Affairs Manager agrees that N is lot busier than L. Why can't we have the TDNC low income housing move to Parkside by L line and still in the District 4. Parkside location is also convenient with shopping and better location for families with children.

I urged you to listen to the D4 residents like myself who is aware of the surroundings and oppose this loan and this project. There are no low income housing by L line. Please have TDNC find another piece of land by the L line. Thank you.

Sincerely,

District 4 resident, Kathy Fong

From:	Miho Gehrman
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	Resolution number #210763, and "7/20/21 BOS meeting"
Date:	Monday, July 19, 2021 10:15:10 PM
Attachments:	Community Update_2550 Irving (7-2-21 final).pdf

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

  Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

  Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
  It should be right-sized to 4 stories.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Resident,[Miho Gehrman 1250 27th Ave SF CA, 94122]

COMMUNITY UPDATE

Department of Toxic Substances Control – Our mission is to protect the people, communities, and environment of California from harmful chemicals by cleaning up contaminated sites, enforcing hazardous waste laws, and compelling the development of safer products.

Public Comment Period for 2550 Irving Street
Draft Response Plan Available for Review

The California Department of Toxic Substances Control (DTSC) invites you to review and comment on the draft Response Plan for 2550 Irving Street, San Francisco, CA 94122 (Site). The Tenderloin Neighborhood Development Corporation (TNDC) is proposing to build an affordable housing complex on the property. TNDC is responsible for addressing on-site contamination to support future property redevelopment. The draft Response Plan proposes the installation of a vapor intrusion mitigation system underneath the proposed building. This vapor mitigation system is a barrier that is installed as part of the building foundation to prevent tetrachloroethylene (PCE) found in soil vapor (spaces between soil particles) at the Site from entering the indoor air.

PUBLIC COMMENT PERIOD
July 12, 2021 TO August 13, 2021

DTSC invites you to review and comment on the draft Response Plan for the 2550 Irving Street. All comments must be mailed or emailed by **August 13, 2021** to:
Arthur Machado
DTSC Project Manager
700 Heinz Avenue
Berkeley, CA 94710
Arthur.Machado@dtsc.ca.gov

REMOTE PUBLIC MEETING: DTSC will host a remote public meeting to provide information on the draft Response Plan, answer questions and receive public comments:
Date: Thursday, July 22, 2021
Time: 6:30 to 8:30 p.m.
Link: https://tinyurl.com/2550Irving
Phone Number: Call 1-669-900-9128 and enter Meeting ID 849 7778 3128#
Contact Asha Setty, DTSC Public Participation Specialist, at (510) 540-3910, toll-free at (866) 495-5651 or Asha.Setty@dtsc.ca.gov for assistance.

Site History and Environmental Investigations
The 0.44-acre Site housed several businesses from 1895 to 1946, including a drugstore, two gas stations, and a dry cleaner. In 1966, the property was used as a mortuary and funeral chapel. The funeral business operated until 1985, when the building was modified for its current use as a bank.

The property has been owned by The Police Credit Union since 1987. Environmental investigations conducted in 2019 and 2020 found PCE above environmental screening levels in soil vapor at the Site, at the adjacent parking lot, and along Irving Street. PCE was not detected above screening levels in soil or groundwater on-site. PCE is a volatile organic compound that is commonly used in dry-cleaning operations and in household products such as cleaning supplies, paints, adhesives and air fresheners. The California Air Resources Board is phasing PCE out of dry-cleaning operations by 2023. Sampling results indicate that the indoor air of The Police Credit Union is acceptable for workers and customers.

The levels of PCE at the Site are suitable for commercial/industrial use. Action is needed in order to ensure the Site is suitable for residential use. Environmental investigations for areas along Irving Street indicate that PCE in soil vapor is within the acceptable risk range for residential use. The Police Credit Union is responsible for monitoring off-site contamination. DTSC will prepare a separate mailer to update the community about this monitoring. In addition, DTSC will be providing oversight for the investigation of the former Albright Cleaners located across the street (2511 Irving Street) and will prepare an additional mailer for this process.

Draft Response Plan
The draft Response Plan evaluates engineering controls and recommends a preferred method to address on-Site contamination. The proposed remedy includes:

- Incorporating a vapor intrusion mitigation system under the foundation of the future building. This system consists of an engineered barrier and piping that allows contaminants in soil vapor to be vented into the atmosphere above the building where they will naturally dissipate.
- Installing plugs along underground utility corridors and sealing utility piping to prevent vapors from travelling into or off-site.
- Collecting samples to confirm the vapor intrusion mitigation system is operating as designed prior to building occupancy.
- Recording a land use covenant to allow residential use of the property with a vapor intrusion mitigation system.
- Monitoring and maintaining the system to ensure it remains effective.

If the draft Response Plan is approved, it is anticipated that the demolition of the existing building and construction of the new building would begin in 2023. A work notice would be mailed to the community prior to the start of work.

Safety Measures
The vapor intrusion mitigation system would be installed at the same time the building is constructed. To protect the health of the community during this work, the following engineering controls and safety measures would be used:

- Active work areas would be fenced off and include Site signage with a phone number to report any concerns.

- Dust monitoring would occur upwind and downwind of excavation areas and along the Site perimeter.
- Various methods would be used to control dust including water, spray foam, and plastic sheeting.

California Environmental Quality Act (CEQA)
DTSC will prepare a Notice of Exemption for this affordable housing project because it is exempt from CEQA under California Senate Bill 35. The Notice of Exemption would be filed with the State Clearinghouse after project approval.

Next Steps
DTSC will review and consider all public comments before making a decision on the draft Response Plan for the project. At the end of the public comment period, DTSC will evaluate all comments received and make any necessary changes to these documents. DTSC will send a Response to Comments document to all those who submit comments and provide their contact information.

Information Repositories
You can review a hard copy of the draft Response Plan at the following location:

- DTSC Berkeley Office, located at 700 Heinz Avenue, Berkeley, CA 94710. Please call the office at (510) 540-2122 to make an appointment to view the documents.
- To review the draft Response Plan and related documents online, please visit: https://www.envirostor.dtsc.ca.gov/public/ (type site code 60003063 and select from the drop-down menu)
- For air monitoring results and additional technical documents online, please visit: https://www.envirostor.dtsc.ca.gov/public/ (type site code 60003000 and select from the drop-down menu)

DTSC Contact Information

- Arthur Machado, Project Manager at (415) 723-0792 or Arthur.Machado@dtsc.ca.gov
- Asha Setty, Public Participation Specialist at (510) 540-3910, toll-free at (866) 495- 5651 or Asha.Setty@dtsc.ca.gov
- For Media Inquiries: Russ Edmondson, Public Information Officer, (916) 323-3372 or Russ.Edmondson@dtsc.ca.gov



Figure 1: Site Location and Soil Vapor Sampling Locations

From:	Clifford Lowell
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	BOS 7/20/21 meeting, file # 210763, 2550 Irving Street Loan
Date:	Monday, July 19, 2021 10:10:29 PM

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Dear Mr. Mar and fellow Supervisors,
As a resident of the outer Sunset, I am writing to ask that you decline the pre-development loan for the 2550 Irving Affordable Housing development.
While I agree that SF and the Sunset district clearly needs more affordable housing options for our citizens, the proposal for 2550 Irving is simply the wrong way to go. The 7 story building proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times the size of the biggest building in the area, which was built in the late 1920s. Nobody will want to live in a building that is out of character of the neighborhood. Affordable housing is most successful when the scale and design of the housing blends in with the surrounding neighborhood. Frankly, living in a structure that is so different from everything around it will stigmatize the residents and will certainly NOT engender pride of ownership or a sense of personal responsibility. The proposed building will reinforce the socio-economic isolation of tenants. Other proposed affordable housing units in the Sunset are all 4-5 stories high. A similar sized building at 2550 Irving would be much more successful and much more desirable. I would welcome an appropriate sized building. But building a 7 story structure, just because of economic pressure, will sully the neighborhood and fail the new residents. The TNDC should look for additional sites and build more appropriate sized affordable housing units.
Sincerely,

Clifford Lowell
1215 27th Ave
SF, CA

From:	Katie Calhoun
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Subject:	Opposing 2550 Irving St Loan, 7/20/21 BOS meeting, File No. 210763
Date:	Monday, July 19, 2021 10:09:01 PM

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Dear Supervisor Mar and Mayor Breed,

My family bought our home on 28th Avenue and Irving in 1994. We have loved the diversity of our neighborhood, our Outer Sunset quirks and quietness. Our kids can't afford to live here, we could never afford to live here now.

Change is inevitable and our need for affordable housing is critical. If this location is a location you have thoughtfully considered, I am not qualified to argue with that for this low income housing purpose.

However, I do argue with the size, number of units, height and parking. Irving is a small, narrow, 1-2 story max street. Dropping a massive 7 story building there is totally out of character, inappropriate and wrong for the neighborhood. It's not about who will live there, it's about those residents joining our community, our neighborhood and including them in our wonderful environment. Wrecking it for all of us with a starkly wrong structure, just because you can, is thoughtless, inconsistent with the purpose of you bringing new neighbors to join us and forcing all of us to hate it before you start.

Already the N Judah is the most congested muni line, it doesn't pick us up (yes, all the way out at 28th Avenue stop it's already full and pulls past us) and the City is about to close MLK and/or Middle Drive in GG Park---pushing traffic onto Lincoln. Lincoln is incredibly congested. Have you tried driving kids to school and getting down Lincoln, Irving or Judah at 8am? We used to move all the way over to Kirkham (now closed for slow streets too) just to get to school on time.

My point is, unless you live and drive and park and move in the outer Sunset, it's not as easy as you think and the services do not accommodate us now.

Please allow us to welcome these new residents in this new Irving low income housing building with welcome open arms. YOU have the power by accommodating our request to lower the height and add parking.

I know you are busy "listening" to the Sunset neighbors. My question is are you "DOING" anything? I have not seen that yet. Listening is only useful if you HEAR us.

Thank you. Katie Calhoun

Katie Calhoun | President
CALHOUN & COMPANY COMMUNICATIONS
415-346-2929, office | 415-225-2062, cell | calhounwine.com

From: Susan Tam
To: Wong, Linda (BOS)
Subject: Resolution number #210763 oppose letter for 7/20/21 BOS meeting
Date: Monday, July 19, 2021 8:48:25 PM

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***** Oppose *****

I'm writing to oppose the plan to build a seven story, 100-unit low income housing project at 2550 Irving St. As a resident in the sunset neighborhood for 25+ years, I think this project is out of place and bad for the sunset district.

Our main concerns will be the increase in crime, burglaries, loitering, parking problems, increased homeless presence, loss of home value, noise, increases of trash, drug use, and many more. Please STOP this project immediately and please respect all the residents/homeowners in this neighborhood.

Thank you for your time and understanding.

Susan Tam
1270 25th Avenue
San Francisco, CA 94122

From:	Judi McManigal
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, London (MYR)
Subject:	OPPOSE resolution 210763; 7/20/21 BOS meeting
Date:	Monday, July 19, 2021 8:14:13 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar, Board of Supervisors, Mayor Breed, and related parties,

I own my home at 1490 35th Avenue, in Sup. Mar's district. I have lived in SF my entire life except for college. I am a former social worker and attorney, and am in favor of affordable housing, including new housing built in the Sunset.

However, I strongly **OPPOSE** the 2550 Irving development as it is currently being proposed. It is ill-conceived and too large, without providing sufficient parking or public transportation. I know from personal and regular experience that Irving Street is already an overcrowded corridor with insufficient parking; I fear this hurts local small businesses. As a daily Muni rider, I am also keenly aware that there was dramatically insufficient space and service on the N Judah line prior to COVID. A housing development of the proposed size would exacerbate both problems. I also understand there may be some issues with toxins. I don't wish to comment on aspects about which I am not knowledgeable, so I would like to learn more about that.

Sup. Mar, I urge you to consider your voting constituents. Let's keep the conversation going. Let's get more affordable housing in the Sunset, but not this current project.

Respectfully,

Judi McManigal

From: mei chen
To: Wong, Linda (BOS)
Subject: Oppose 2550 Irving building project
Date: Monday, July 19, 2021 7:50:48 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Hi my name is Mei, I live on 23rd Irving street, I oppose 2550 Irving building project!
Too high!
Always traffic problems on Irving street!
Toxic spread to our neighborhood, it will effect our health and our children's health!!!!!
thank you!
Get Outlook for iOS

From: mei chen
To: Wong, Linda (BOS)
Subject: Oppose 2550 Irving building project
Date: Monday, July 19, 2021 7:27:34 PM

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I’m oppose 2550 Irving building project

Get Outlook for iOS

From: andrew chow
To: Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Peskin, Aaron (BOS)
Cc: 2550irvingcommunity@gmail.com
Subject: #210763 oppose letter for 7/20/21 BOS meeting
Date: Monday, July 19, 2021 6:52:48 PM

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OPPOSE

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident, and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development, and I oppose the project as currently proposed. Our city and the Sunset desperately need more Affordable Housing, but 2550 Irving Street is not the solution as presented. Here are my concerns:

● TOO OUT OF SCALE - The seven-story building proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least three times that of the enormous building in the area built in the late 20s. Affordable housing is most successful when the scale and design blend in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high. Building seven stories directly adjacent to the Sunset's tiniest homes not only rob neighbors of their privacy and solar rights but also reinforces tenants' socio-economic isolation. It should be right-sized to 4 stories.

● TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site, including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings, and building ADUs to house even more families in D4 ultimately. Also, who's are oversee the project to ensure the money is appropriately used? How much is each organization (TNDC) going to receive for its operation?

● PARKING - Not enough Parking spaces, and with only 11 parking spaces added for additional 300+ people to this block.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated four-story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,
District 4 Resident, [Andrew Chow]
1257 27th AVE
San Francisco CA 94122

From:	Kerry Koller
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS)
Subject:	BOS 7/20/21 meeting, file # 210763, 2550 Irving Street Loan
Date:	Monday, July 19, 2021 6:16:06 PM

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Dear Board of Supervisors,

I'm writing to ask you to vote **NO** on the $14M predevelopment loan that allows TNDC to buy 2550 Irving Street for 100% affordable housing. I am a firm supporter of increasing affordable housing in San Francisco, including in District 4. However, the current proposal by TNDC to develop a 7 story building on Irving Street has a number of issues I feel need to be addressed.

I'm most concerned about the cost of the procurement of the parcel, especially considering the evidence of PCE contamination on the site that could adversely affect the value of the land. I feel like the agreed upon purchase price is too high, which will lead to difficulties in obtaining the necessary financing to complete the project.

I urge the BOS to investigate the financing of this project in more depth before committing so much of the city's resources to this project.

Sincerely,
Kerry Koller
1215 27th Avenue

From: Terry Clothe
To: Wong, Linda (BOS)
Subject: Fwd: 2550 Irving Street Project
Date: Monday, July 19, 2021 6:00:31 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Ms. Wong:

I'm writing to you today to let you know how I feel as a neighbor of Irving St. I OPPOSEthe 7 storage project by TNDC, but will support the 4 or 5 storage project modification plan by MSNA for 2550 Irving St Project. Please vote NO on the 14 million dollar loan and No on this proposal while there are still so many unsolved concerns like toxicity, community safety, density and parking.

Thank you!
Jennifer Li

From:	Judith Pelzner
To:	Mar, Gordon (BOS)
Cc:	Lew, Lisa (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS)
Subject:	Board of Supervisor Meeting 7.20.21 - Resolution number #210763
Date:	Monday, July 19, 2021 5:23:48 PM

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Dear Supervisor Mar and the Board of Supervisors,

I am a longtime Sunset resident/homeowner and I appose the approval of the pre-development loan for 2550 Irving Affordable Housing Development and I oppose the project as currently proposed.Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution.

One of my main concerns with this project is the Environmental impact that this will have on the neighborhood as well as the PCE vapors that have been found underground at 2550 Irving St site as well as south side of Irving St. Before adding more residents, the toxic plume on both sides of the street should and needs to be remediated. A full environmental review of the project should also be conducted to determine how this 7 story will impact the surrounding houses. Since this building is on the North side of Irving St., the other houses north of the building on 27th and 26th Avenues will have their Sun reduced significantly. Most of these Sunset houses have a center patio that allows for natural light to reach areas of the house that would not normally have this light, mainly the middle of the house. The original architectures built these houses this way because they were building them so so close together, this center patio was the only way to allow these houses to have natural light at the middle of their homes otherwise they would only have light at the front and back of the houses. While we may all now have electricity, that does not make up for natural sun light that comes into our homes

Overall, I am also deeply concerned that there is a lack in interest and consideration for the concerns for the exiting homeowners that this project will affect the home values and the quality of life. It also appears to us that you may not be bringing the appropriate attention to the health and safety concerns by not addressing and pursuing remediation of the soil. There has also got to be more communication between the city and the residents of District 4, to say nothing of those families that live in the immediate area and who will be most affected by this project. The city needs to discuss now how it will increase its support in services for this neighborhood because as it stands currently, it seems that the city is ready to place more people in the area but not add additional services to support the increase neighborhoods needs.

Sincerely,

Judith Pelzner
1658 32nd Avenue
Resident of District 4.

From:	Lew, Lisa (BOS)
To:	Board of Supervisors, (BOS); Wong, Linda (BOS)
Subject:	FW: Resolution 210763 to be Voted on at the 7/20/21 Board of Supervisor"s Meeting
Date:	Monday, July 19, 2021 5:03:23 PM
Attachments:	image001.png

For File No. 210763.

Lisa Lew
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T 415-554-7718 | F 415-554-5163
lisa.lew@sfgov.org | www.sfbos.org

(VIRTUAL APPOINTMENTS) To schedule a "virtual" meeting with me (on Microsoft Teams), please ask and I can answer your questions in real time.
Due to the current COVID-19 health emergency and the Shelter in Place Order, the Office of the Clerk of the Board is working remotely while providing complete access to the legislative process and our services.

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From: Bronwyn Gundogdu <brongun9@gmail.com>
Sent: Monday, July 19, 2021 3:56 PM
To: Lew, Lisa (BOS) <lisa.lew@sfgov.org>
Subject: Re: Resolution 210763 to be Voted on at the 7/20/21 Board of Supervisor's Meeting

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Lisa Lew,

I write today to express my **OPPOSITION** to the planned construction of a seven story building on 2550 Irving Street, San Francisco.

The proposed building is completely out of proportion for that neighborhood. I can only imagine the distresss the building's immediate neighbor's are feeling now contemplating the thought of a 7 story high rise being constructed next to them, completely blocking out the sun except for perhaps a few hours of sun at the height of summer - perhaps!

I applaud the plan to build affordable housing - obviously we badly need it. But this should not come at the expense of tearing a neighborhood apart and ruining the homes of the neighbors, as this mammoth project threatens to do.

I strongly recommend the Board of Supervisors reconsider this proposed building and limit the building to a height that blends in with the neighborhood - that is of no more than 3 stories, or 4 at the absolute maximum.

Proposing housing for the "homeless" is always a delicate issue. The City's Supervisors are responsible for dealing with the many challenges that face this city. But they are also responsible to ALL the city's constituents - including supporting the needs of the majority of San Franciscans who pay taxes and who have worked hard and saved hard to live in a specific neighborhood. Instead of railroading over the legitimate objections of neighbors, creating resentment both to city government as well as the proposed low income tenants in the process, the City would do a much better job by providing low income housing that fits in with the local community. Housing for "the poor" shouldn't be made to look like that - it should blend in and become virtually indistinguishable from its neighbors. This proposed plan for a 7 story building does not fit in with the low rise buildings of the Sunset and is causing much neighborhood outrage. (Some may respond that a high rise building already exists immediately opposite this planned construction, but that high rise along with a few others in the Sunset district, were build many years ago and none have been built since that initial construction).

To offer some alternatives - I propose the following:

1. Seriously look at the buildings downtown to review current vacancies following the exodus of companies and people out of San Francsisco as a possible sight for housing - in already constructed buildings.

2. Seriously look at under-developed land already owned by the City and County of San Francisco - eg the currently boarded up Juvenile Hall, or the site of the third tower that was originally planned for the new Laguna Honda Hospital but was never built. That land already exists and is free from toxic waste. Both of these sites would lend themselves to construction of high(er) rise buildings as their construction would not interfere with sunlight to neighbors and they would fit in with currently built high rises.

It has become apparent that many residents of San Francisco are becoming increasingly angry with "City Hall" for the relentless rising crime, the filth, increasing lack of parking, etc and the apparent inability of the Board of Supervisors to deal with this. I strongly recommend that the Board of Supervisors stop only responding to a minority of "activists" and respond to the legitimate concerns of the Sunset community and **OPPOSE the construction of the massive seven story development at 2550 Irving Street.**

Respectfully,

Bronwyn Gundogdu
1458 11th Ave
San Francisco

From:	Lew, Lisa (BOS)
To:	Board of Supervisors, (BOS); Wong, Linda (BOS)
Subject:	FW: Comment for file#210763
Date:	Monday, July 19, 2021 5:03:09 PM
Attachments:	image001.png

For File No. 210763.

Lisa Lew
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T 415-554-7718 | F 415-554-5163
lisa.lew@sfgov.org | www.sfbos.org

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From: Kit Chong <kittsechong@gmail.com>
Sent: Monday, July 19, 2021 3:23 PM
To: Lew, Lisa (BOS) <lisa.lew@sfgov.org>
Subject: Fwd: Comment for file#210763

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---------- Forwarded message ---------
From: **Kit Chong** <kittsechong@gmail.com>
Date: Mon, Jul 19, 2021, 3:14 PM
Subject: Comment for file#210763
To: <Gorden.Mar@sfgov.org>

Dear superior ,

I live at 26th Ave , between Irving and Lincoln. I strongly oppose the 7 floor project plan by TNDC and support the 4 floor project modify plan by MSNA for 2550 Irving Street project.. I concern the parking, increasing crimes ,toxic ,community safety those unsolved issue.
Sincerely,
Kit

From:	MM
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Subject:	Oppose 2550 Irving St. Loan, 7/20/21 BOS meeting, File No. 210763
Date:	Monday, July 19, 2021 4:55:49 PM

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Dear Supervisor Mar and the Board of Supervisors:

I am a Sunset resident and a member of a Neighborhood Organization registered with the Planning Department. I have reviewed and evaluated dozens of proposed developments in the neighborhood and will categorically state that what is proposed for 2550 Irving St. is one of the most asinine, ill-conceived potential constructions that I have ever seen.

The potential adverse environmental impacts from this project clearly outweigh any potential good that might come out of the realization of this project. The Planning Department has failed miserably to comply with CEQA guidelines on similar proposals (though private and speculative) in the neighborhood and has proven to be both incompetent and foolish by acting like an enterprise agency, seeking revenue from developers in the form of fees and working hand-in-glove with them.

Before doling out taxpayer money, in the form of a loan, to "non-profit" developers, it would be wise to consider the sentiments of district residents, many of whom the City uses as an ATM when it comes to tax dollars.

A full environmental review of this site with a detailed plan for remediation should be undertaken prior to funding. No one wants to be sprayed with toxic airborne contaminants or have to suffer and pay for toxic groundwater in the blend.

In addition, it may be useful to consider the context; that is, if a taller than human-scale building (greater than 4 stories) is right for the neighborhood. A simple walkabout would indicate that it simply is not.

Given the well-publicized corruption in City government at present, with a perpetual Federal investigation, a proposed project like this one, so clearly inappropriate for the proposed site, does not pass the smell test. Unworthy of consideration, it should not even be at the Board. As it is,

please vote No on funding it.

Best regards,

Mike Murphy
Volunteer, Outlands Planning Council
Director, San Francisco Watershed Protection Alliance

From: Vonnie McGee
To: Mar, Gordon (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Board of Supervisors, (BOS)
Subject: 2550 Irving Project Objection
Date: Monday, July 19, 2021 4:45:17 PM

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Sample Letter To Gordon Mar and BOS

Dear Supervisor Mar and the Board of Supervisors,

Our family owns the building at 2501 Irving Street, directly across from this proposed project. We have major concerns about the approval of the pre-development loan for 2550 Irving Affordable Housing development and we oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are our concerns:

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

  Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

  Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
  It should be right-sized to 4 stories.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%. We are very concerned that our tenants, both Sterling Bank employees and customers and our apartment tenants above the bank will have a very difficult time finding parking with the current project.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides

of the block needs to be remediated. A full environmental review of the project should be conducted.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

We urge you to listen to your neighbors and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

Sean and Vonnie McGee

From:	tina cen
To:	Board of Supervisors, (BOS); BOS Legislation, (BOS); Mar, Gordon (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Peskin, Aaron (BOS)
Subject:	Re: Fw: Resolution number #210763 oppose letter for 7/20/21 BOS meeting
Date:	Monday, July 19, 2021 4:37:57 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Board of Supervisors:
My family and I have been homeowners in the Central Sunset District since 1971. I'm also a Realtor working in District 4 since 2004.
I **"Oppose"** the building of a seven story structure on unstable ground that is toxic. I **"Oppose"** adding 100 units and/or 300 families with only 11 parking spaces to live in already congested Irving Street.

I support Affordable Housing but I do not support destroying the livelihood of neighboring communities. As a veteran real estate consultant, I can tell you that the houses adjacent to the proposed out of place building will lose hundreds of thousand dollars in equity value. How can people who support this building sleep at night knowing that this will happen to these long time residents?

Here are my suggestions:
1. The Police Credit Union should clean up the toxic site and or reimburse the new owner for the clean up.
2. Build a 4 story building with 50 percent parking for the number of units.
3. Purchase already vacant properties in the Sunset and add ADU's. This is a better way to diversify District 4 and spend less than 1M per door. Local real estate companies can manage the properties at the minimum and therefore saving more funds for the truly needy.
4. Build affordable housing on the Ocean Beach parking lots or at the edge/Lincoln Avenue side of Golden Gate Park . These areas are rarely used except by the homeless and coyotes.

Please build and or purchase affordable housing but **DO NOT destroy our neighborhood.**

Sincerely,

Tina Cen-Camarao
1559 21st Avenue
San Francisco, CA 94122

On Mon, Jul 19, 2021 at 4:36 PM Tina Cen <tinacentc@yahoo.com> wrote:

Tina Cen-Camarao
(415) 815-9518
tinacentc@yahoo.com

----- Forwarded Message -----
From: Tina Cen <tinacentc@yahoo.com>
To: board.of.supervisors@sfgov.org <board.of.supervisors@sfgov.org>; bos.legislation@sfgov.org <bos.legislation@sfgov.org>; Gordon Mar <gordon.mar@sfgov.org>
Cc: linda.wong@sfgov.org <linda.wong@sfgov.org>; john.carroll@sfgov.org <john.carroll@sfgov.org>; lisa.lew@sfgov.org <lisa.lew@sfgov.org>; aaron.peskin@sfgov.org <aaron.peskin@sfgov.org>
Sent: Monday, July 19, 2021, 04:35:30 PM PDT
Subject: Re: Resolution number #210763 oppose letter for 7/20/21 BOS meeting

Dear Board of Supervisors:
My family and I have been homeowners in the Central Sunset District since 1971. I'm also a Realtor working in District 4 since 2004.
I **"Oppose"** the building of a seven story structure on unstable ground that is toxic. I **"Oppose"** adding 100 units and/or 300 families with only 11 parking spaces to live in already congested Irving Street.

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Here are my suggestions:
1. The Police Credit Union should clean up the toxic site and or reimburse the new owner for the clean up.
2. Build a 4 story building with 50 percent parking for the number of units.
3. Purchase already vacant properties in the Sunset and add ADU's. This is a better way to diversify District 4 and spend less than 1M per door. Local real estate companies can manage the properties at the minimum and therefore saving more funds for the truly needy.

4. Build affordable housing on the Ocean Beach parking lots or at the edge/Lincoln Avenue side of Golden Gate Park . These areas are rarely used except by the homeless and coyotes.

Please build and or purchase affordable housing but **DO NOT destroy our neighborhood.**

Sincerely,

Tina Cen-Camarao
1559 21st Avenue
San Francisco, CA 94122

From:	Annie Chu
To:	Lew, Lisa (BOS); BOS Legislation, (BOS); Board of Supervisors, (BOS); Carroll, John (BOS); Mar, Gordon (BOS); Wong, Linda (BOS)
Subject:	Content for file #210763 BOS meeting 7/20/2021
Date:	Monday, July 19, 2021 4:36:57 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Re: Oppose the 7 floor project plan for 2550 Irving Street.
>
> I live at 21th Ave,between Judah and Irving Streets,I oppose the 7 floor project plan by TNDC and support the 4 floor project modify plan by MSNA for 2550 Irving Street project ,I concern the parking,Toxic,Density,Community safety those unsolved issued.
>
>
> Annie Chu.
> Sent from my iPhone

From:	Sarah Pelzner
To:	Mar, Gordon (BOS)
Cc:	Board of Supervisors, (BOS); Carroll, John (BOS); BOS Legislation, (BOS); Lew, Lisa (BOS); Wong, Linda (BOS)
Subject:	Board of Supervisor Meeting 7.20.21 - Resolution number #210763
Date:	Monday, July 19, 2021 4:36:00 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a long time Sunset resident and I **oppose** the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution and I believe that this process has gone too quickly and should be put on hold in order to allow further discussions amongst environmental experts and in collaboration with the neighborhood the construction of this building will affect.

Here are my four main concerns:
● TOO OUT OF SCALE FOR THE NEIGHBORHOOD - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s. Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high. Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants. It should be resized to be about 4 stories.

● TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

● ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted. Frankly as a citizen I am surprised this is not being talked about more and I am disappointed that this issue doesn't seem to be as urgent for people who are saying that more affordable housing is needed, yet you are willing to let those who need the affordable housing the most (the families with young children, elderly, ect...) to live in a place that may not be safe and healthy to reside in long term, not to mention all the other families in the area already.

● INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools. The N Judah pre pandemic was horrible at rush hour 4 PM thru 6:30 PM (not counting Baseball games and now Basketball Games days). Often our trains were switched to other Letters (L,M, or Ks) in the tunnel so 10+ minutes would go by before another arrived and usually it was already packed

(depending on where you get on). Or the trains were switched back at 19th Ave and another train wasn't scheduled to arrive for another 10+ minutes. I have never heard users of the L,M, and K complain as much as I have heard users of the N trains. For these switches, they never seemed to explain why they needed to switch back at that time and 9 out of 10 times it wasn't due to mechanical issues. Adding that significant amount of people to this area is going to put a strain on the N Judah (and other Muni Buses) and without collaboration with SFMTA it's going to become a nightmare for the residents, both new and old.

In conclusion this project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement. I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

Sarah Pelzner
1658 32nd Avenue
District 4 Resident,

From: Tina Cen
To: Board of Supervisors, (BOS); BOS Legislation, (BOS); Mar, Gordon (BOS)
Cc: Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Peskin, Aaron (BOS)
Subject: Re: Resolution number #210763 oppose letter for 7/20/21 BOS meeting
Date: Monday, July 19, 2021 4:35:57 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Board of Supervisors:
My family and I have been homeowners in the Central Sunset District since 1971. I'm also a Realtor working in District 4 since 2004.
I **"Oppose"** the building of a seven story structure on unstable ground that is toxic. I **"Oppose"** adding 100 units and/or 300 families with only 11 parking spaces to live in already congested Irving Street.

I support Affordable Housing but I do not support destroying the livelihood of neighboring communities. As a veteran real estate consultant, I can tell you that the houses adjacent to the proposed out of place building will lose hundreds of thousand dollars in equity value. How can people who support this building sleep at night knowing that this will happen to these long time residents?

Here are my suggestions:
1. The Police Credit Union should clean up the toxic site and or reimburse the new owner for the clean up.
2. Build a 4 story building with 50 percent parking for the number of units.
3. Purchase already vacant properties in the Sunset and add ADU's. This is a better way to diversify District 4 and spend less than 1M per door. Local real estate companies can manage the properties at the minimum and therefore saving more funds for the truly needy.
4. Build affordable housing on the Ocean Beach parking lots or at the edge/Lincoln Avenue side of Golden Gate Park . These areas are rarely used except by the homeless and coyotes.

Please build and or purchase affordable housing but **DO NOT destroy our neighborhood.**

Sincerely,

Tina Cen-Camarao
1559 21st Avenue
San Francisco, CA 94122

From: Karen Chang
To: Mar, Gordon (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Subject: Opposing 2550 Irving St Loan, 7/20/21 BOS meeting, File No. 210763
Date: Monday, July 19, 2021 4:35:53 PM
Attachments: Picture.pdf

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Mayor, Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

<!--[if !supportLists]-->● <!--[endif]-->TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
It should be right-sized to 4 stories.

<!--[if !supportLists]-->● <!--[endif]-->TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

<!--[if !supportLists]-->● <!--[endif]-->PARKING - Only 11% parking ratio is

proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

<!--[if !supportLists]-->● <!--[endif]-->ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

<!--[if !supportLists]-->● <!--[endif]-->CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

<!--[if !supportLists]-->● <!--[endif]-->INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Resident, Karen Chang


LOOKING SOUTH ON 25TH AVE.

From:	Edwin Camarao
To:	Board of Supervisors, (BOS); BOS Legislation, (BOS)
Cc:	Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Peskin, Aaron (BOS)
Subject:	Resolution number #210763 oppose letter for 7/20/21 BOS meeting
Date:	Monday, July 19, 2021 4:29:47 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Board of Supervisors:
My family and I have been homeowners in the Central Sunset District since 1971. I'm also a Realtor working in District 4 since 1989.
I **"Oppose"** the building of a seven story structure on unstable ground that is toxic.
I **"Oppose"** adding 100 units and/or 300 families with only 11 parking spaces to live in already congested Irving Street.

I support Affordable Housing but I do not support destroying the livelihood of neighboring communities. As a veteran real estate consultant, I can tell you that the houses adjacent to the proposed out of place building will lose hundreds of thousand dollars in equity value. How can people who support this building sleep at night knowing that this will happen to these long time residents?

Here are my suggestions:
1. The Police Credit Union should clean up the toxic site and or reimburse the new owner for the clean up.
2. Build a 4 story building with 50 percent parking for the number of units.
3. Purchase already vacant properties in the Sunset and add ADU's. This is a better way to diversify District 4 and spend less than 1M per door. Local real estate companies can manage the properties at the minimum and therefore saving more funds for the truly needy.
4. Build affordable housing on the Ocean Beach parking lots or at the edge/Lincoln Avenue side of Golden Gate Park . These areas are rarely used except by the homeless and coyotes.

Please build and or purchase affordable housing but **DO NOT destroy our neighborhood.**

Sincerely,

Edwin Camarao
1559 21st Avenue
San Francisco, CA 94122

Realtor Since 1989 DRE Lic# 01042431
My review link:
https://edwincamarao.agent.intero.com/testimonial-tree

https://edwincamarao.agent.intero.com/

Intero Real Estate Services, Inc., A Berkshire Hathaway Affiliate

650.906.7668 Mobile
650.991.2121
650.755.4747 Fax

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From:	Judy Strachan
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	Resolution number #210763, and "7/20/21 BOS meeting" - Approve!
Date:	Monday, July 19, 2021 4:25:58 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

I think this development is exactly what we need in the Sunset! There is a shortage of housing in SF and this looks like a good Sunset neighborhood contribution towards reducing the shortage.

Judy Strachan
2720 Judah Street

Judy Strachan (she/her)
Sent from Mail for Windows 10

From:	Valerie Schmalz
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	"Regarding 2550 Irving St loan (BOS file No. 210753)"
Date:	Monday, July 19, 2021 4:25:48 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisors,

Please vote no on the $14 million predevelopment loan that allows the Tenderloin Neighborhood Development Corporation to buy 2550 Irving Street for 100 percent affordable housing.

I support affordable housing in the Sunset District and believe there are already housing developments in the works that demonstrate that it is possible to build affordable housing in keeping with the neighborhood.

A key reason to vote no on this is because the DTSC has only begun the public comment period on the draft remediation plan and the MSNA has new information that the draft plan is insufficient to keep current and new neighbors safe from PCE contamination.

Sincerely,

Valerie Schmalz
1277-28th Avenue
San Francisco, CA 94122

From: GK
To: Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Cc: nbr5@pm.me
Subject: Opposing 2550 Irving St Loan, 7/20/21 BOS meeting, File No. 210763
Date: Monday, July 19, 2021 4:22:41 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

My wife and I are seniors. Both of us need our cars and due to previous injuries plus our age need to be able to park within what for us is a walkable distance. Because our building does not have parking, this is a critical issue. Due to our fixed income, we cannot possibly afford uber, etc. The responses we have gotten to our questions nobody cares at all. Incredibly thoughtless and will have a big effect on how I have vote in the future.

TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
It should be right-sized to 4 stories.

TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of

the project should be conducted.

CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Residents, Greg Kricheff and Judy Fleischer

1300. 26th Ave., Apt. 305
415-987-9449

From:	Sh H
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	7/20/21 BOS meeting, File No. 210763, Regarding 2550 Irving St loan
Date:	Monday, July 19, 2021 4:07:53 PM
Attachments:	2550irving_neighbor_impact.png

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

To Gordon Mar and the San Francisco Board of Supervisors,

My family, which includes 2 adults, 2 elementary school children and 2 senior grandparents, lives immediately near the proposed 2550 Irving Development. Our house is one of the 2-story buildings right next to the Police Credit Union.

I oppose this loan approval for the project as it is currently proposed and urge the Board and our D4 supervisor Mar to vote no or postpone the vote on this loan until all of the issues around it are resolved including:

- The lack of neighboring community support for the project as it is currently proposed. Start over and make sure a compromise is reached to ensure that this affordable housing development is a success for D4 and ultimately the city.
- PCE vapors and remediation plan by DTSC still being in review - postpone until DTSC has finished its process and all of the environmental issues have been reviewed and addressed.
- Exorbitant costs per unit compared to alternative options - review alternative options for this neighborhood that can bring more affordable housing to D4 cheaper and faster.
- No traffic or transportation study or investment while providing almost no parking for this family oriented development on this already extremely busy stretch of Irving. My family frequently takes the N Judah and from our experience getting around the city with kids on public transportation is currently very problematic and unreliable.
- **No comprehensive plan on how to remedy the impact on immediate neighbors**

like us. This includes shadows (some of neighbors have solar panels or were planning to install them), loss of sunshine and natural light, especially during the “sunnier” fall/winter months in the Sunset, significant loss of privacy (hundreds of windows will now be looking into our bedroom windows), loss of property value as a result.

And very importantly, the construction impact on our 100 year old small homes with old foundations that are very close to this proposed 7 story development being built on sand dunes. There is no precedent in SF of a building this tall being built right next to 2-story 100 year old homes on top of fine grain sand.

There is currently no plan on how the potential damages will be assessed and dealt with.

We understand the urgent need for San Francisco to build affordable housing. All we are asking is that our family be considered just as much as the families and individuals that will live at 2550 Irving St. The goal here should be a win-win for the people joining our community and the current neighboring families, who, as currently proposed, will be negatively impacted by the size and density of the building. The goal should be to get this project right so it can serve as an example of what successful community supported affordable housing in the Sunset can look like.

It is easy for people from other districts or people who don’t live nearby and won’t be impacted to call for the tallest building at 2550 Irving without any regard for the concerns and impact on the immediate neighbors. Most of the callers in support of this loan during the recent Budget Committee meeting were not even from our district. They call themselves YIMBYs but this is not happening in their backyard but in ours and our neighbors'.

That said, us and most of the immediate neighbors support affordable housing development at 2550 Irving St provided that the issues and concerns are addressed and there is a compromise on the height and density.

Please put yourself in our position and oppose the loan for this development as it is currently proposed until the issues described above are addressed.

Thank you,

Shane H.



"This is a renderings created by an architect. It shows my house, my neighbors' houses, and the proposed building. It is not showing the actual design or color, but just the mass of the building."

From: BOS Legislation, (BOS)
To: Board of Supervisors, (BOS); Wong, Linda (BOS)
Cc: BOS Legislation, (BOS)
Subject: FW: Resolution # 210763 to be voted on at the 7/20/21 Board of Suervsior"s Meeting
Date: Monday, July 19, 2021 4:04:18 PM
Attachments: image001.png

For File No. 210763.

Jocelyn Wong
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T: 415.554.7702 | F: 415.554.5163
jocelyn.wong@sfgov.org | www.sfbos.org

(VIRTUAL APPOINTMENTS) To schedule a "virtual" meeting with me (on Microsoft Teams), please ask and I can answer your questions in real time.

Due to the current COVID-19 health emergency and the Shelter in Place Order, the Office of the Clerk of the Board is working remotely while providing complete access to the legislative process and our services



Click here to complete a Board of Supervisors Customer Service Satisfaction form

The Legislative Research Center provides 24-hour access to Board of Supervisors legislation, and archived matters since August 1998.

Disclosures: *Personal information that is provided in communications to the Board of Supervisors is subject to disclosure under the California Public Records Act and the San Francisco Sunshine Ordinance. Personal information provided will not be redacted. Members of the public are not required to provide personal identifying information when they communicate with the Board of Supervisors and its committees. All written or oral communications that members of the public submit to the Clerk's Office regarding pending legislation or hearings will be made available to all members of the public for inspection and copying. The Clerk's Office does not redact any information from these submissions. This means that personal information—including names, phone numbers, addresses and similar information that a member of the public elects to submit to the Board and its committees—may appear on the Board of Supervisors' website or in other public documents that members of the public may inspect or copy.*

From: Bronwyn Gundogdu <brongun9@gmail.com>
Sent: Monday, July 19, 2021 3:35 PM
To: BOS Legislation, (BOS) <bos.legislation@sfgov.org>
Subject: Re: Resolution # 210763 to be voted on at the 7/20/21 Board of Suervsior's Meeting

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Board of Supervisors,

I write today to express my **OPPOSITION** to the planned construction of a seven story building on 2550 Irving Street, San Francisco.

The proposed building is completely out of proportion for that neighborhood. I can only imagine the distresss the building's immediate neighbor's are feeling now contemplating the thought of a 7 story high rise being constructed next to them, completely blocking out the sun except for perhaps a few hours of sun at the height of summer - perhaps!

I applaud the plan to build affordable housing - obviously we badly need it. But this should not come at the expense of tearing a neighborhood apart and ruining the homes of the neighbors, as this mammoth project threatens to do.

I strongly recommend the Board of Supervisors reconsider this proposed building and limit the building to a height that blends in with the neighborhood - that is of no more than 3 stories, or 4 at the absolute maximum.

Proposing housing for the "homeless" is always a delicate issue. As Supervisors, you are responsible for dealing with the many challenges that face this city. But you are also responsible to ALL your constituents - including supporting the needs of the majority of San Franciscans who pay taxes and who have worked hard and saved hard to live in a specific neighborhood. Instead of railroading over the legitimate objections of neighbors, creating resentment both to City government as well as the proposed low income tenants in the process, the City would do a much better job by providing low income housing that fits in with the local community. Housing for "the poor" shouldn't be made to look like that - it should blend in and become virtually indistinguishable from its neighbors. This proposed plan for a 7 story building does not fit in with the low rise buildings of the Sunset and is causing much neighborhood outrage. (Some may respond that a high rise building already exists immediately opposite this planned construction, but that high rise along with a few others in the Sunset district, were build many years ago and none have been built since that initial construction).

To offer some alternatives - I propose the following:

1. Seriously look at the buildings downtown to review current vacancies following the exodus of companies and people out of San Francsisco as a possible sight for housing - in already constructed buildings.

2. Seriously look at under-developed land already owned by the City and County of San Francisco - eg the currently boarded up Juvenile Hall, or the site of the third tower that was originally planned for the new Laguna Honda Hospital but was never built. That land already exists and is free from toxic waste. Both of these sites would lend themselves to construction of high(er) rise buildings as their construction would not interfere with sunlight to neighbors and they would fit in with currently built high rises.

It has become apparent that many residents of San Francisco are becoming increasingly angry with "City Hall" for the relentless rising crime, the filth, increasing lack of parking, etc and the apparent inability of the Board of Supervisors to deal with this. I strongly recommend that you stop only responding to a minority of "activists" and respond to the legitimate concerns of the Sunset community and **OPPOSE the construction of the massive seven story development at 2550 Irving Street.**

Respectfully,

Bronwyn Gundogdu
1458 11th Ave
San Francisco

From: BOS Legislation, (BOS)
To: Board of Supervisors, (BOS); Wong, Linda (BOS)
Cc: BOS Legislation, (BOS)
Subject: FW: Comment for file#210763
Date: Monday, July 19, 2021 4:03:55 PM
Attachments: image001.png

For File No. 210763.

Jocelyn Wong
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T: 415.554.7702 | F: 415.554.5163
jocelyn.wong@sfgov.org | www.sfbos.org

(VIRTUAL APPOINTMENTS) To schedule a "virtual" meeting with me (on Microsoft Teams), please ask and I can answer your questions in real time.

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From: Kit Chong <kittsechong@gmail.com>
Sent: Monday, July 19, 2021 3:30 PM
To: BOS Legislation, (BOS) <bos.legislation@sfgov.org>
Subject: Fwd: Comment for file#210763

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---------- Forwarded message ---------
From: **Kit Chong** <kittsechong@gmail.com>
Date: Mon, Jul 19, 2021, 3:14 PM
Subject: Comment for file#210763
To: <Gorden.Mar@sfgov.org>

Dear superior ,
I live at 26th Ave , between Irving and Lincoln. I strongly oppose the 7 floor project plan by TNDC and support the 4 floor project modify plan by MSNA for 2550 Irving Street project.. I concern the parking, increasing crimes ,toxic ,community safety those unsolved issue.
Sincerely,
Kit

From:	BOS Legislation, (BOS)
To:	Board of Supervisors, (BOS); Wong, Linda (BOS)
Cc:	BOS Legislation, (BOS)
Subject:	FW: Comment for file#210763
Date:	Monday, July 19, 2021 4:03:31 PM
Attachments:	image001.png

For File No. 210763.

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From: Kit Chong <kittsechong@gmail.com>
Sent: Monday, July 19, 2021 3:20 PM
To: BOS Legislation, (BOS) <bos.legislation@sfgov.org>
Subject: Fwd: Comment for file#210763

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From: **Kit Chong** <kittsechong@gmail.com>
Date: Mon, Jul 19, 2021, 3:14 PM
Subject: Comment for file#210763
To: <Gorden.Mar@sfgov.org>

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Sincerely,
Kit

From: BOS Legislation, (BOS)
To: Board of Supervisors, (BOS); Wong, Linda (BOS)
Cc: BOS Legislation, (BOS)
Subject: FW: The Loan is inconsistent with the General Plan
Date: Monday, July 19, 2021 4:03:02 PM
Attachments: Screen Shot 2021-07-19 at 3.05.39 PM.png
Screen Shot 2021-05-20 at 12.44.08 PM.png
image001.png

For File No. 210763.

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From: Adam Michels <adamgmichels@yahoo.com>
Sent: Monday, July 19, 2021 3:18 PM
To: BOS Legislation, (BOS) <bos.legislation@sfgov.org>; Breed, Mayor London (MYR) <mayorlondonbreed@sfgov.org>; Enoch Wang <enochwang@fifelawllp.com>; San Francisco Mid-Sunset Neighborhood Association Board <msna-board@googlegroups.com>; Peskin, Aaron (BOS) <aaron.peskin@sfgov.org>; Mar, Gordon (BOS) <gordon.mar@sfgov.org>; Garavaglia <mike@garavaglia.com>
Subject: The Loan is inconsistent with the General Plan

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisors and Mayor Breed,

This is notice that MSNA and its attorney and architect (and expert on neighborhood character) have found the loan to be inconsistent with the General Plan of San Francisco, and since a General Plan Referral was issued, you must hold a public hearing before approving the loan or you will be out of compliance with the San Francisco Administrative Code.

Recently the Mid Sunset Neighborhood Association's attorney has brought to the attention of the Planning Department that the General Plan Referral was improperly issued because before such a referral is issued, SF Administrative Code section **2A.53 requires a public hearing** and determination by the Planning Commission for any proposal which is complex, is inconsistent with the General Plan, or has generated public controversy. Each of these is applicable to the proposed project that the loan would be financing. At minimum, the proposed project is inconsistent with Priority General Plan Policies, No. 2 and 4. The Planning Department has yet to respond. The proposed building is out of scale with surrounding building and inconsistent with the neighborhood character. Supervisor Mar, Eric Shaw, and Mayor Breed conceded these points when we me with them. (No. 2 Is that existing housing and neighborhood character be conserved and protected.) (No. 4 is that traffic not overburden the streets or parking)

Points from San Francisco's General Plan

Visual Harmony (3.1)

1. New buildings should be made sympathetic to the scale, form and proportion of older development.

2. Much effort has been made in the past to relate each new building to its neighbors at both upper and lower levels, and to avoid jarring contrasts that would upset the city pattern.

3. A building at the wrong location can be utterly disruptive.

I have presented this to the Mayor, Supervisor Mar, and Eric Shaw. None of them were able contest the point that the loan is for a building that is out of scale and jarring in contrast. Also, the building will likely cause a significant impact on traffic and parking.
In fact, every architect and project manager I have consulted agrees that this building is out of scale.

“Significant impacts to the Parkway Terrace Historic District will result from the presence of the proposed, overpowering, 7-story structure at the edge of the district. It will be a significant change to the setting and feeling of the neighborhood. This will reduce the historical integrity of the historic resource and should be considered for further environmental review. There is no way, except through massing & height reductions, to lessen the effect of a 75’ tall, block-wide, wall. Not only is there an effect on the historic resource, but it is also a very poor urban design response for an precedent setting affordable housing project.”

-- Mike Garavaglia, San Francisco Architect



"This is a renderings created by an architect. It shows my house, my neighbors' houses, and the proposed building. It is not showing the actual design or color, but just the mass of the building."

Adam Michels
1275 26th Ave.

From:	BOS Legislation, (BOS)
To:	Board of Supervisors, (BOS); Wong, Linda (BOS)
Cc:	BOS Legislation, (BOS)
Subject:	FW: For File #210763
Date:	Monday, July 19, 2021 4:02:31 PM
Attachments:	image001.png

For File No. 210763.

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From: Sherry Lau <slaufu@yahoo.com>
Sent: Monday, July 19, 2021 3:00 PM
To: BOS Legislation, (BOS) <bos.legislation@sfgov.org>
Subject: For File #210763

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Hi all,

I live at 41st Avenue, between Noriega n Ortega. I opposed the 7 floor project plan by TNDC and support the 4 floor project modify plan by MSNA for 2550 Irving St.project.. I concern the parking, toxic, density, community safety those unsolved issues.

Thanks,

Sherry
Sent from my iPad

From: BOS Legislation, (BOS)
To: Board of Supervisors, (BOS); Wong, Linda (BOS)
Cc: BOS Legislation, (BOS)
Subject: FW: Resolution #210763 July 20, 2021 BOS meeting
Date: Monday, July 19, 2021 4:01:45 PM
Attachments: image001.png

For File No. 210763.

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From: hobb2@juno.com <hobb2@juno.com>
Sent: Monday, July 19, 2021 2:37 PM
To: BOS Legislation, (BOS) <bos.legislation@sfgov.org>
Subject: Resolution #210763 July 20, 2021 BOS meeting

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Dear Supervisor Mar and the Board of Supervisors,

My name is Sherri Samu, and I live in District 4 of San Francisco's Sunset neighborhood. **I <u>oppose</u> the approval of the pre-development loan for 2550 Irving Affordable Housing development and <u>I oppose</u> the project as currently proposed.**

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

- **TOO OUT OF SCALE** - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s. Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high. Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants. It should be right-sized to 4 stories.
- **ENVIRONMENTAL CONCERNS** - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be done.
- **INFRASTRUCTURE** - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.
- **PARKING** - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well

as existing residents and businesses.

Sincerely,
Sherri Samu, District 4 Resident
address: 1228 26th Avenue

From: BOS Legislation, (BOS)
To: Board of Supervisors, (BOS); Wong, Linda (BOS)
Cc: BOS Legislation, (BOS)
Subject: FW: Resolution number #21073 and 6/20/21 BOS meeting
Date: Monday, July 19, 2021 4:01:00 PM
Attachments: image001.png

For File No. 210763.

Jocelyn Wong
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
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From: Isadore Rosenthal <isadore.rosenthal@gmail.com>
Sent: Monday, July 19, 2021 1:24 PM
To: BOS Legislation, (BOS) <bos.legislation@sfgov.org>
Subject: Re: Resolution number #21073 and 6/20/21 BOS meeting

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On Mon, Jul 19, 2021, 1:20 PM Isadore Rosenthal <isadore.rosenthal@gmail.com> wrote:

> I am a Sunset resident and I OPPOSE the approval for the development loan for 2550 Irving Affordable Housing development and I OPPOSE the project as currently proposed.
>
> Our city and the Sunset desperately need more affordable housing but as proposed, 2550 Irving is not the solution. Here are more concerns: TOO EXPENSIVE - This proposal comes with $1 million/unit price tag and this is 60% over the average for new Affordable Housing in San Francisco. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabilitating other buildings and building ADU's to ultimately house even more families in D4. ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving site as well the south side if 2450 Irving St. Before adding more new residents, the toxic plume on both sides need to be remediated. PARKING - I am disabled and often require a DIABLED BLUE parking space. Finding a designated BLUE PARKING space on Irving St. is already difficult, With only 11% parking ratio proposed, this will mean that the difficulty in finding parking for every Sunset resident and business, including me, will be3 compounded. A 25% parking ratio is needed.
>
> I urge you to listen to the D4 residentsts like myself and OPPOSE this loan and this project in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St. for the benefit of new as well as existing residents and businesses.
>
> Sincerely, Isadore Rosenthal, District 4 resident

From: BOS Legislation, (BOS)
To: Board of Supervisors, (BOS); Wong, Linda (BOS)
Cc: BOS Legislation, (BOS)
Subject: FW: Comment for file #21076
Date: Monday, July 19, 2021 4:00:34 PM
Attachments: image001.png

For File No. 210763.

Jocelyn Wong
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
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From: Phoebe Kuong <kuong1628@gmail.com>
Sent: Monday, July 19, 2021 1:17 PM
To: BOS Legislation, (BOS) <bos.legislation@sfgov.org>
Subject: Comment for file #21076

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I live in 28 ave and Layton?I oppose the 7 floor project plan by TNDC and support the 4 floor project modify plan by MSNA for 2550 Irving St project ,I concern the parking toxic density community safety unsolved issues , thanks

From: Bronwyn Gundogdu
To: Wong, Linda (BOS)
Subject: Re: Resolution # 210763 to be voted on at the 7/20/21 Board of Supervisor"s Meeting
Date: Monday, July 19, 2021 3:54:15 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Linda Wong,

I write today to express my **OPPOSITION** to the planned construction of a seven story building on 2550 Irving Street, San Francisco.

The proposed building is completely out of proportion for that neighborhood. I can only imagine the distresss the building's immediate neighbor's are feeling now contemplating the thought of a 7 story high rise being constructed next to them, completely blocking out the sun except for perhaps a few hours of sun at the height of summer - perhaps!

I applaud the plan to build affordable housing - obviously we badly need it. But this should not come at the expense of tearing a neighborhood apart and ruining the homes of the neighbors, as this mammoth project threatens to do.

I strongly recommend the Board of Supervisors reconsider this proposed building and limit the building to a height that blends in with the neighborhood - that is of no more than 3 stories, or 4 at the absolute maximum.

Proposing housing for the "homeless" is always a delicate issue. The City's Supervisors are responsible for dealing with the many challenges that face this city. But they are also responsible to ALL the city's constituents - including supporting the needs of the majority of San Franciscans who pay taxes and who have worked hard and saved hard to live in a specific neighborhood. Instead of railroading over the legitimate objections of neighbors, creating resentment both to city government as well as the proposed low income tenants in the process, the City would do a much better job by providing low income housing that fits in with the local community. Housing for "the poor" shouldn't be made to look like that - it should blend in and become virtually indistinguishable from its neighbors. This proposed plan for a 7 story building does not fit in with the low rise buildings of the Sunset and is causing much neighborhood outrage. (Some may respond that a high rise building already exists immediately opposite this planned construction, but that high rise along with a few others in the Sunset district, were build many years ago and none have been built since that initial construction).

To offer some alternatives - I propose the following:

1. Seriously look at the buildings downtown to review current vacancies following the exodus of companies and people out of San Francsisco as a possible sight for housing - in already constructed buildings.

2. Seriously look at under-developed land already owned by the City and County of San Francisco - eg the currently boarded up Juvenile Hall, or the site of the third tower that was originally planned for the new Laguna Honda Hospital but was never built. That land already exists and is free from toxic waste. Both of these sites would lend themselves to construction of high(er) rise buildings as their construction would not interfere with sunlight to neighbors and they would fit in with currently built high rises.

It has become apparent that many residents of San Francisco are becoming increasingly angry with "City Hall" for the relentless rising crime, the filth, increasing lack of parking, etc and the apparent inability of the Board of Supervisors to deal with this. I strongly recommend that the Board of Supervisors stop only responding to a minority of "activists" and respond to the legitimate concerns of the Sunset community and **OPPOSE the construction of the massive seven story development at 2550 Irving Street.**

Respectfully,

Bronwyn Gundogdu
1458 11th Ave
San Francisco

From:	Steve Ward
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	Inappropriate Density Policy & Consequences Resolution number #210763, and "7/20/21 BOS meeting / "Oppose"
Date:	Monday, July 19, 2021 3:49:28 PM

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Dear Ladies and Gentlemen,

Defend against inappropriate density policy and its severe consequences for San Francisco in general and specifically as it applies to the Sunset District.

. San Francisco is the most dense major metropolitan area in the United States west of the Hudson River.

. The Sunset District is unique having an amphitheater layout which is destroyed by high buildings in the lower contours.

. Other alternatives for housing should be considered first before burdening neighborhoods and infrastructure with increased density. Examples:
- . Empty skyscrapers
- . Lower density areas outside the city especially those ravaged by fire.
- . Enact vacancy control to stop evictions.

In the most dense city other than Manhattan we should have a policy that respects and benefits the welfare of the majority of the people who live in the area where the development is going to rest first.

Please reject the loan to TNDC. It sets the wrong precedent.

Steve Ward
25 yr.s in D4

From: MLaffan
To: Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Mar, Gordon (BOS)
Subject: Resolution number #210763, 7/20/21 BOS meeting
Date: Monday, July 19, 2021 3:29:05 PM

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Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident for the past 20 years and I **oppose** the approval of the pre-development loan for 2550 Irving Affordable Housing development and **I oppose the project as currently proposed.**

More Affordable Housing is badly needed however as **proposed**, 2550 Irving Street is not the solution. I have the following concerns:

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF.

- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as **proposed** in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,
Marian Laffan
1458 26th Avenue , SF 94122.
District 4 Resident

Sent from my iPhone

From: Kit Chong
To: Wong, Linda (BOS)
Subject: Fwd: Comment for file#210763
Date: Monday, July 19, 2021 3:26:29 PM

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---------- Forwarded message ---------
From: **Kit Chong** <kittsechong@gmail.com>
Date: Mon, Jul 19, 2021, 3:14 PM
Subject: Comment for file#210763
To: <Gorden.Mar@sfgov.org>

Dear superior ,
I live at 26th Ave , between Irving and Lincoln. I strongly oppose the 7 floor project plan by TNDC and support the 4 floor project modify plan by MSNA for 2550 Irving Street project.. I concern the parking, increasing crimes ,toxic ,community safety those unsolved issue.
Sincerely,
Kit

From:	Marsha Grandchamp
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS)
Cc:	Wong, Linda (BOS); BOS Legislation, (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	2550 Irving St. Loan (BOS file #210763)
Date:	Monday, July 19, 2021 3:26:04 PM

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Dear Board of Supervisors,
I'm writing to ask you to vote NO on the $14M predevelopment loan that allows TNDC to buy 2550 Irving Street for 100% affordable housing. I am an avid supporter of affordable housing in District 4 but there are several reasons this project concerns me. The key reason to vote no now is it's premature to approve the loan when DTSC has only just begun the public comment period on the draft remediation plan, and we have already learned new information that tells us this draft plan is insufficient to keep current and new neighbors safe from PCE contamination.

I am very concerned about my health and that of my neighbors who are adjacent to the property. Thank you for considering giving this remediation plan a more thorough review before a decision is made about funding.

Sincerely,
Marsha Grandchamp
1281 27th Avenue

From:	Lew, Lisa (BOS)
To:	Board of Supervisors, (BOS); Wong, Linda (BOS)
Subject:	FW: For File# 210763
Date:	Monday, July 19, 2021 3:21:51 PM
Attachments:	image001.png

For File No. 210763.

Lisa Lew
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T 415-554-7718 | F 415-554-5163
lisa.lew@sfgov.org | www.sfbos.org

(VIRTUAL APPOINTMENTS) To schedule a "virtual" meeting with me (on Microsoft Teams), please ask and I can answer your questions in real time.
Due to the current COVID-19 health emergency and the Shelter in Place Order, the Office of the Clerk of the Board is working remotely while providing complete access to the legislative process and our services.

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From: Sherry Lau <slaufu@yahoo.com>
Sent: Monday, July 19, 2021 3:03 PM
To: Lew, Lisa (BOS) <lisa.lew@sfgov.org>
Subject: For File# 210763

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Hi Lisa,

I live at 41st Avenue, between Noriega n Ortega. I opposed the 7 floor project plan by TNDC and support the 4 floor project modify plan by MSNA for 2550 Irving St.project.. I concern the parking, toxic, density, community safety those unsolved issues.

Thanks,

Sherry
Sent from my iPad

From:	Lew, Lisa (BOS)
To:	Board of Supervisors, (BOS); Wong, Linda (BOS)
Subject:	FW: Fw:BOS file No.210763(Regarding 2550 Irving St loan "7/20/21 BOS meeting" OPPOSE
Date:	Monday, July 19, 2021 3:21:32 PM
Attachments:	image001.png

For File No. 210763.

Lisa Lew
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
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From: Hal Silk <halsilk@gmail.com>
Sent: Monday, July 19, 2021 2:59 PM
To: Lew, Lisa (BOS) <lisa.lew@sfgov.org>
Subject: Re: Fw:BOS file No.210763(Regarding 2550 Irving St loan "7/20/21 BOS meeting" OPPOSE

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor,
I am writing to ask you to vote no at this time on the $14 million pre-development loan that would authorize TNDC to buy the 2550 Irving site for affordable housing. I support building affordable housing, but this location poses a serious issue that needs to be investigated and resolved before the City underwrites this project.
PCE toxins have been found at the site and are currently being monitored by the California State DTSC. Their process for public comment has just begun, and if a hazardous condition is determined to exist, and could be exacerbated by construction, remediation could be required, which could alter

the feasibility of the project.
Being direct neighbors of the proposed site, we, of course, are genuinely concerned about the release of toxins during construction, are eager to see the results of the State's investigation and hope that the Board of Supervisors will postpone a decision on the predevelopment funding until the report is issued.

Respectfully,

Doreen and Hal Silk
1270 26th Ave.415 566-0492

415 519-8037

From: Celeste Marty
To: Board of Supervisors, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Mar, Gordon (BOS); BOS Legislation, (BOS); Lew, Lisa (BOS)
Subject: File #210763
Date: Monday, July 19, 2021 3:07:24 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:-

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late ‘20s.

Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

Building 7 stories directly adjacent to the Sunset’s tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
It should be right-sized to 4 stories.

We need Design with Dignity — I can’t imagine the lack of quality of life for families living in a densified hotel development like this. There are many examples of affordable housing that offer much better choices for the families living in them. Please study them, so you can be accountable to the families who will eventually move in.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a

smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,
Celeste Marty
1273 28th Ave

From:	Lew, Lisa (BOS)
To:	Board of Supervisors, (BOS); Wong, Linda (BOS)
Subject:	FW: Resolution #210763 July 20, 2021 BOS meeting
Date:	Monday, July 19, 2021 2:54:01 PM
Attachments:	image001.png

For File No. 210763.

Lisa Lew
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T 415-554-7718 | F 415-554-5163
lisa.lew@sfgov.org | www.sfbos.org

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From: hobb2@juno.com <hobb2@juno.com>
Sent: Monday, July 19, 2021 2:41 PM
To: Lew, Lisa (BOS) <lisa.lew@sfgov.org>
Subject: Resolution #210763 July 20, 2021 BOS meeting

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

My name is Sherri Samu, and I live in District 4 of San Francisco's Sunset neighborhood. **I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.**

Our city and the Sunset desperately need more Affordable Housing, but as

proposed, 2550 Irving Street is not the solution. Here are my concerns:

- **TOO OUT OF SCALE** - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s. Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high. Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants. It should be right-sized to 4 stories.
- **ENVIRONMENTAL CONCERNS** - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be done.
- **INFRASTRUCTURE** - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.
- **PARKING** - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,
Sherri Samu, District 4 Resident
address: 1228 26th Avenue

From:	Hal Silk
To:	Wong, Linda (BOS)
Subject:	Re: Fw:BOS file No.210763(Regarding 2550 Irving St loan "7/20/21 BOS meeting" OPPOSE
Date:	Monday, July 19, 2021 2:51:21 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor,
I am writing to ask you to vote no at this time on the $14 million pre-development loan that would authorize TNDC to buy the 2550 Irving site for affordable housing. I support building affordable housing, but this location poses a serious issue that needs to be investigated and resolved before the City underwrites this project.
PCE toxins have been found at the site and are currently being monitored by the California State DTSC. Their process for public comment has just begun, and if a hazardous condition is determined to exist, and could be exacerbated by construction, remediation could be required, which could alter the feasibility of the project.
Being direct neighbors of the proposed site, we, of course, are genuinely concerned about the release of toxins during construction, are eager to see the results of the State's investigation and hope that the Board of Supervisors will postpone a decision on the predevelopment funding until the report is issued.

Respectfully,

Doreen and Hal Silk
1270 26th Ave.415 566-0492

415 519-8037

From:	BARBARA ECKART
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Cc:	Barbara Eckart
Subject:	Opposing 2550 Irving St Loan, 7/20/21 BOS meeting, File No. 210763
Date:	Monday, July 19, 2021 2:46:36 PM

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While I support building low income housing in the Sunset district I oppose the current proposal of the high-rise structure being proposed — a Four story building with adequate parking should be built in this neighborhood - we need affordable housing - the current proposal is costly and does not make sense. You need to rethink how you are spending funds for affordable housing - purchase land which is market value and not inflated pricing — renogiate the purchase price and hire designers and architects who have knowledge and experience in building affordable housing. Our city and our district deserve knowing that city funds are being invested appropriately and not being wasted. Do not let politics play a role in this important and much needed housing project.

Barbara Eckart

From:	Hanley Lau
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Subject:	Oppose!! Resolution number #210763, and "7/20/21 BOS meeting. Opposing 2550 Irving St Loan, 7/20/21 BOS meeting, File No. 210763
Date:	Monday, July 19, 2021 2:43:44 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
It should be right-sized to 4 stories.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at

2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and

reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Resident,
Hanley Lau

From:	anita asturias
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	OPPOSE: Resolution #210763; 7/20/21 BOS Meeting
Date:	Monday, July 19, 2021 2:43:36 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors:

I am a Sunset resident and I OPPOSE the approval of the pre-development loan for 2550 Irving Affordable Housing development and I OPPOSE the project as currently proposed.

The proposed project at 2550 Irving St. is not the solution to the affordable housing problem. My concerns are as follows:

TOO OUT OF SCALE - The proposed 7-story building is at least three times larger than the biggest building in the area. The scale and design should fit in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high. This project should be right-sized to four stories. This is a quality of life issue for everyone in the neighborhood.

TOO EXPENSIVE - This proposal will cost about $1 million per unit - 60% over the average for new affordable housing in San Francisco. This loan is not a good deal for the taxpayers of San Francisco. The affordable housing crisis cannot be solved with one outrageously expensive building.

INFRASTRUCTURE - Adding over 300 residents to this block will have a significant impact on traffic, transit, water, sewer and schools. Shouldn't the city complete an impact study and address these problems before committing such a large amount of money to this project?

I was raised in the Sunset and my family is committed to making sure it is a desirable place to live. I support and patronize the shops on Irving and appreciate the hard work that the merchants and restaurateurs expend every day to keep their small businesses afloat. It isn't fair to them to force such a drastic change without at least attempting to investigate and address their concerns.

A huge part of the infrastructure concerns transit. I am speaking from experience when I say that MTA can NOT handle additional passengers (assuming the number of passengers rebounds after pandemic restrictions are lifted). Thirty years ago I rode the N Judah to work in the Civic Center area every day, and service was horrible then. I would wait for the "N" train every afternoon and watch as train after train would pass by, already too full to take on any more passengers. The situation has only gotten worse. Residents are forced to drive and are punished by dwindling parking options.

I am old enough to remember the old housing projects that were opened with great optimism and promise and which ended with blight and misery for the entire neighborhood and which were ultimately condemned (e.g., the "Pink Palace"). As elected officials, you are mandated to represent current residents. Please don't ignore and dismiss our concerns. We have the right to be heard with respect.

Please listen to Sunset residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated four-story development at 2550 Irving St. for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Residents,
Anita Asturias
Wayne Pickering, Jr.
2374 36th Avenue

Sent from my iPad

From: hobb2@juno.com
To: Wong, Linda (BOS)
Subject: Resolution #210763 July 20, 2021 BOS meeting
Date: Monday, July 19, 2021 2:40:01 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

My name is Sherri Samu, and I live in District 4 of San Francisco's Sunset neighborhood. **I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.**

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

- **TOO OUT OF SCALE** - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s. Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high. Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants. It should be right-sized to 4 stories.
- **ENVIRONMENTAL CONCERNS** - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be done.
- **INFRASTRUCTURE** - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.
- **PARKING** - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,
Sherri Samu, District 4 Resident
address: 1228 26th Avenue

From:	ROZ LAW
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Subject:	Resolution number #210763 on 7/20/21 BOS meeting to Opposing 2550 Irving St Loan, 7/20/21 BOS meeting, File No. 210763 OPPOSE!
Date:	Monday, July 19, 2021 2:38:42 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

  Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

  Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
  It should be right-sized to 4 stories.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found

underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Resident, Rose Lau

From:	Lisa Tsang
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Subject:	Opposing Irving St. Loan, 7/20/21 BOS meeting File No. 210763
Date:	Monday, July 19, 2021 2:34:32 PM

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Dear Supervisors:

I oppose 2550 Irving Street project as following

1. Natural resource environmental issue and sustainability
   a. Water b. Air and Sunshine c. Infrastructure
2. Density increase are a bad idea
   a. San Francisco is already the second most densely populated city in U.S. after NY
   b. Density is a health Hazard in a Pandemic
   c. " Units "is not the same as "People"
3. Earthquakes, Fires, AwSs and Public Safety

Thanks for your time and consideration in this matter!

Lisa Tsang
S.F. Voter

From: knittyme@yahoo.com
To: Wong, Linda (BOS)
Subject: Resolution number #210763, and "7/20/21 BOS meeting"
Date: Monday, July 19, 2021 2:11:02 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Linda Wong,

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Thank you for your time.

Sincerely,
Judy Yee
1511 27th Avenue
District 4 Resident

Sent from my iPhone

From:	Nancy Lee
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Subject:	Resolution #210763 - 2550 Irving Affordable Housing Dev
Date:	Monday, July 19, 2021 1:45:14 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Mayor London Breed, Supervisor Mar and the Board of Supervisors,

I grew up in the Sunset, and my family still resides at 1369 22nd Ave, San Francisco, CA. My husband and I now live in District 7, but we own a four-unit apartment building at 2650 Irving Street -- one block from the proposed 2550 Irving Affordable Housing development. My family **opposes** the approval of the pre-development loan for 2550 Irving Affordable Housing development, and we **oppose** the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

  Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high. Furthermore, the City should learn from past experience that massive low-income housing projects that are out-of-scaled from the surrounding neighborhood reinforces the socio-economic isolation of tenants and have failed in the past. Why does the City want to make the same mistake again?

  Building 7 stories directly adjacent to the Sunset's tiniest homes robs neighbors of their privacy and solar rights. In addition, constructing the type of foundation required for a 7 story high building in the sandy soil conditions may pose risks to the adjacent foundations of existing single-family homes. The proposed project should be right-sized to no more than 4 stories.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget

on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 stakeholders like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

Nancy Lee
District 7 Resident, District 4 Stakeholder

From:	Joan Klau
To:	Safai, Ahsha (BOS); SafaiStaff (BOS)
Cc:	Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject:	Discrepancies with BOS file# 210763, BOS meeting 7/20/21
Date:	Monday, July 19, 2021 1:40:33 PM
Attachments:	BOS_meeting072021_DTSCletter.pdf cVOC_040110_SVE.pdf 21-WCP-032 Appraisal Report Revised Final.pdf MSNA_BOSSafai_CoverLetter_BOSfile210763.pdf

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Supervisor Ahsha Safai
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisor Safai,

I am the financial representative from Mid Sunset Neighborhood Association (MSNA) writing with regard to Resolution # 210763. The following information was not part of the record considered by the Budget and Finance Committee on 7/15/21, and should be considered by the full Board before it approves resolution #210763 on 7/20/21 for the loan at 2550 Irving.

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If the resolution is approved and the City commits to financing $14.3 million for acquisition and predevelopment, the faulty appraisal will not pass scrutiny of the California Tax Credit Allocation Committee (CTCAC) and other lenders.

Sincerely,
Joan Klau, Mid Sunset Neighborhood Association

CC:
linda.wong@sfgov.org
john.carroll@sfgov.org
lisa.lew@sfgov.org
bos.legislation@sfgov.org

Attachments:
Paul Holzman's letter
Draft Response Plan, available at https://app.box.com/s/7pw2xg66muepst387q78quwiro68xmd4
6/7/21 appraisal

From:	Joan Klau
To:	Haney, Matt (BOS); Haneystaff (BOS)
Cc:	Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject:	Discrepancies with BOS file# 210763, BOS meeting 7/20/21
Date:	Monday, July 19, 2021 1:38:02 PM
Attachments:	BOS_meeting072021_DTSCletter.pdf cVOC_040110_SVE.pdf 21-WCP-032 Appraisal Report Revised Final.pdf MSNA_BOSHaney_CoverLetter_BOSfile210763.pdf

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Supervisor Matt Haney
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisor Haney,

I am the financial representative from Mid Sunset Neighborhood Association (MSNA) writing with regard to Resolution # 210763. The following information was not part of the record considered by the Budget and Finance Committee on 7/15/21, and should be considered by the full Board before it approves resolution #210763 on 7/20/21 for the loan at 2550 Irving.

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CC:
linda.wong@sfgov.org
john.carroll@sfgov.org
lisa.lew@sfgov.org
bos.legislation@sfgov.org

Attachments:
Paul Holzman's letter
Draft Response Plan, available at https://app.box.com/s/7pw2xg66muepst387q78quwiro68xmd4
6/7/21 appraisal

From:	Joan Klau
To:	Stefani, Catherine (BOS); StefaniStaff, (BOS)
Cc:	Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject:	Discrepancies with BOS file# 210763, BOS meeting 7/20/21
Date:	Monday, July 19, 2021 1:11:10 PM
Attachments:	BOS_meeting072021_DTSCletter.pdf cVOC_040110_SVE.pdf 21-WCP-032 Appraisal Report Revised Final.pdf MSNA_BOSStefani_CoverLetter_BOSfile210763.pdf

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Supervisor Catherine Stefani
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisor Stefani,

I am the financial representative from Mid Sunset Neighborhood Association (MSNA) writing with regard to Resolution # 210763. The following information was not part of the record considered by the Budget and Finance Committee on 7/15/21, and should be considered by the full Board before it approves resolution #210763 on 7/20/21 for the loan at 2550 Irving.

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Sincerely,
Joan Klau, Mid Sunset Neighborhood Association

CC:
linda.wong@sfgov.org
john.carroll@sfgov.org
lisa.lew@sfgov.org
bos.legislation@sfgov.org

Attachments:
Paul Holzman's letter
Draft Response Plan, available at https://app.box.com/s/7pw2xg66muepst387q78quwiro68xmd4
6/7/21 appraisal

From:	Joan Klau
To:	Ronen, Hillary; RonenStaff (BOS)
Cc:	Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject:	Discrepancies with BOS file# 210763, BOS meeting 7/20/21
Date:	Monday, July 19, 2021 1:09:26 PM
Attachments:	BOS_meeting072021_DTSCletter.pdf cVOC_040110_SVE.pdf 21-WCP-032 Appraisal Report Revised Final.pdf MSNA_BOSRonen_CoverLetter_BOSfile210763.pdf

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Supervisor Hillary Ronen
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisor Ronen,

I am the financial representative from Mid Sunset Neighborhood Association (MSNA) writing with regard to Resolution # 210763. The following information was not part of the record considered by the Budget and Finance Committee on 7/15/21, and should be considered by the full Board before it approves resolution #210763 on 7/20/21 for the loan at 2550 Irving.

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Sincerely,
Joan Klau, Mid Sunset Neighborhood Association

CC:
linda.wong@sfgov.org
john.carroll@sfgov.org
lisa.lew@sfgov.org
bos.legislation@sfgov.org

Attachments:
Paul Holzman's letter
Draft Response Plan, available at https://app.box.com/s/7pw2xg66muepst387q78quwiro68xmd4
6/7/21 appraisal

From:	Joan Klau
To:	Preston, Dean (BOS); PrestonStaff (BOS)
Cc:	Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject:	Discrepancies with BOS file# 210763, BOS meeting 7/20/21
Date:	Monday, July 19, 2021 12:29:35 PM
Attachments:	BOS_meeting072021_DTSCletter.pdf cVOC_040110_SVE.pdf 21-WCP-032 Appraisal Report Revised Final.pdf MSNA_BOSPreston_CoverLetter_BOSfile210763.pdf

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Supervisor Dean Preston
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisor Preston,

I am the financial representative from Mid Sunset Neighborhood Association (MSNA) writing with regard to Resolution # 210763. The following information was not part of the record considered by the Budget and Finance Committee on 7/15/21, and should be considered by the full Board before it approves resolution #210763 on 7/20/21 for the loan at 2550 Irving.

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Sincerely,
Joan Klau, Mid Sunset Neighborhood Association

CC:
linda.wong@sfgov.org
john.carroll@sfgov.org
lisa.lew@sfgov.org
bos.legislation@sfgov.org

Attachments:
Paul Holzman's letter
Draft Response Plan, available at https://app.box.com/s/7pw2xg66muepst387q78quwiro68xmd4
6/7/21 appraisal

From:	Joan Klau
To:	Peskin, Aaron (BOS); PeskinStaff (BOS)
Cc:	Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject:	Discrepancies with BOS file# 210763, BOS meeting 7/20/21
Date:	Monday, July 19, 2021 12:27:50 PM
Attachments:	BOS_meeting072021_DTSCletter.pdf cVOC_040110_SVE.pdf 21-WCP-032 Appraisal Report Revised Final.pdf MSNA_BOSPeskin_CoverLetter_BOSfile210763.pdf

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Supervisor Aaron Peskin
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisor Peskin,

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Sincerely,
Joan Klau, Mid Sunset Neighborhood Association

CC:
linda.wong@sfgov.org
john.carroll@sfgov.org
lisa.lew@sfgov.org
bos.legislation@sfgov.org

Attachments:
Paul Holzman's letter
Draft Response Plan, available at https://app.box.com/s/7pw2xg66muepst387q78quwiro68xmd4
6/7/21 appraisal

From:	Joan Klau
To:	Melgar, Myrna (BOS); MelgarStaff (BOS)
Cc:	Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject:	Discrepancies with BOS file# 210763, BOS meeting 7/20/21
Date:	Monday, July 19, 2021 12:26:04 PM
Attachments:	BOS_meeting072021_DTSCletter.pdf cVOC_040110_SVE.pdf 21-WCP-032 Appraisal Report Revised Final.pdf MSNA_BOSMelgar_CoverLetter_BOSfile210763.pdf

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Supervisor Myrna Melgar
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisor Melgar,

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CC:
linda.wong@sfgov.org
john.carroll@sfgov.org
lisa.lew@sfgov.org
bos.legislation@sfgov.org

Attachments:
Paul Holzman's letter
Draft Response Plan, available at https://app.box.com/s/7pw2xg66muepst387q78quwiro68xmd4
6/7/21 appraisal

From:	Joan Klau
To:	Mandelman, Rafael (BOS); MandelmanStaff, [BOS]
Cc:	Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject:	Re: Fwd: Re: Discrepancies with BOS file# 210763, BOS meeting 7/20/21
Date:	Monday, July 19, 2021 12:24:08 PM
Attachments:	BOS_meeting072021_DTSCletter.pdf cVOC_040110_SVE.pdf 21-WCP-032 Appraisal Report Revised Final.pdf MSNA_BOSMandelman_CoverLetter_BOSfile210763.pdf

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Supervisor Rafael Mandelman
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisor Mandelman,

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CC:
linda.wong@sfgov.org
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lisa.lew@sfgov.org
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Attachments:
Paul Holzman's letter
Draft Response Plan, available at https://app.box.com/s/7pw2xg66muepst387q78quwiro68xmd4
6/7/21 appraisal

From:	Joan Klau
To:	Mar, Gordon (BOS); Marstaff (BOS)
Cc:	Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject:	Fwd: Re: Discrepancies with BOS file# 210763, BOS meeting 7/20/21
Date:	Monday, July 19, 2021 12:21:55 PM
Attachments:	BOS_meeting072021_DTSCletter.pdf cVOC_040110_SVE.pdf 21-WCP-032 Appraisal Report Revised Final.pdf MSNA_BOSMar_CoverLetter_BOSfile210763.pdf

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Supervisor Gordon Mar
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisor Mar,

I am the financial representative from Mid Sunset Neighborhood Association (MSNA) writing with regard to Resolution # 210763. The following information was not part of the record considered by the Budget and Finance Committee on 7/15/21, and should be considered by the full Board before it approves resolution #210763 on 7/20/21 for the loan at 2550 Irving.

The appraisal (attached) is fatally and fundamentally flawed in its methodology and would not hold up to peer review according to an experienced commercial appraiser who reviewed it.

Below are the flaws identified by the expert appraiser:

(1) It states in the cover letter that this is a fee simple appraisal. However, on page 30 it states that the appraisal assumes entitlements which would make it a hypothetical appraisal.

(2) The appraisal fails to state the list price for the property and how many offers were made. This further lacks credibility.

(3) The appraisal does not account for the additional cost of remediation. This is a factual error. It stated that, "Upon inspection of the subject site, the appraiser did not observe any toxic contamination on the property....There is also an estimated $120,000 in environmental mitigation costs for soil removal and a vapor intrusion mitigation system." In the draft response plan which was not made available to the Budget and Finance Committee and not part of the record, TNDC recommended $799k for remediation plus $500k for monitoring costs. (In Paul Holzman's attached letter summarizing the environmental issues and why the Board cannot rely on DTSC approving the draft response plan after the comment period closes, Mr. Holzman explains why the costs are

unknown and may be significantly more.)

(4) Comps 1, 2, 4, and 5 are not proper comps for 2550 Irving. Comp 4 is government purchased with entitlements in place. Comp 2 is where the City is going to buy the property. Comp 1 is in a much better neighborhood than 2550 Irving and was bought with entitlements in place. Comp 5 is in a much better neighborhood.

(5) Comp 3 decreased the purchase price after toxic contaminants were found. Comparably, the appraisal for 2550 Irving would be decreased at least 20 percent.

If the resolution is approved and the City commits to financing $14.3 million for acquisition and predevelopment, the faulty appraisal will not pass scrutiny of the California Tax Credit Allocation Committee (CTCAC) and other lenders.

Sincerely,
Joan Klau, Mid Sunset Neighborhood Association

CC:
linda.wong@sfgov.org
john.carroll@sfgov.org
lisa.lew@sfgov.org
bos.legislation@sfgov.org

Attachments:
Paul Holzman's letter
Draft Response Plan, available at https://app.box.com/s/7pw2xg66muepst387q78quwiro68xmd4
6/7/21 appraisal

From:	Joan Klau
To:	Walton, Shamann (BOS); Waltonstaff (BOS)
Cc:	Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject:	Re: Discrepancies with BOS file# 210763, BOS meeting 7/20/21
Date:	Monday, July 19, 2021 12:18:55 PM
Attachments:	BOS_meeting072021_DTSCletter.pdf cVOC_040110_SVE.pdf 21-WCP-032 Appraisal Report Revised Final.pdf MSNA_BOSWalton_CoverLetter_BOSfile210763.pdf

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Supervisor Shamann Walton
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisor Walton,

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6/7/21 appraisal

From: Joan Klau
To: Chan, Connie (BOS); ChanStaff (BOS)
Cc: Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject: Discrepancies with BOS file# 210763, BOS meeting 7/20/21
Date: Monday, July 19, 2021 12:17:53 PM
Attachments: MSNA_BOSChan_CoverLetter_BOSfile210763.pdf
BOS_meeting07202l_DTSCletter.pdf
pVOC_040110_SVE.pdf
21-WCP-032 Appraisal Report Revised Final.pdf

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Supervisor Connie Chan
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisor Connie Chan,

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6/7/21 appraisal

From: Joan Klau
To: Board of Supervisors, (BOS)
Cc: Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); BOS Legislation, (BOS)
Subject: Community input re BOS file# 210763 for 7/20/21 BOS meeting
Date: Monday, July 19, 2021 12:09:55 PM
Attachments: BOS_meeting072021_DTSCletter.pdf
21-WCP-032 Appraisal Report Revised Final.pdf
MSNA_BOS_CoverLetter_BOSfile210763.pdf

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Board of Supervisors
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
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July 19, 2021

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6/7/21 appraisal

Subject: Re: File No. 210763, BOS meeting 7/20/21 DTSC and 2550 Irving St.

Dear Supervisor Ronen:

I am the liaison with DTSC for MSNA and have been working closely with Arthur Machado, who is managing the final decision for TNDC's draft response plan. The draft response plan was not part of the record that was considered by the Budget and Finance Committee on July 14, 2021 even though MOHCD referred to it as an "approved" plan in order to persuade the supervisors to move the loan forward to the full Board of Supervisors for a vote.

We are at the beginning of DTSC's 30-day comment phase for the draft response plan. In order to bolster their case with the Budget and Finance Committee, MOHCD's Amy Chan made the following statement to Supervisor Mar when he questioned why TNDC and MOHCD couldn't have waited (as was stipulated by the loan and purchase agreement) until DTSC's public comment period was over and the response plan approved. Ms. Chan said:

"We don't believe that there would be any new information coming from DTSC. As Jacob [Noonan] has mentioned the draft response plan has already been reviewed and preliminarily approved. And there won't be any new information coming from that process, which will conclude in mid August."

As DTSC will tell you, they do not "preliminarily approve" a draft. Additionally, by assuming there will be no new information that will come from the comment period, MOHCD and TNDC are dismissing an extremely important part of DTSC's process.

MOHCD is mistaken. There is and will be new information coming. For example, because DTSC recently saw the state of the neighbors' 100-year old crumbling foundations, they are asking the Police Credit Union (PCU) to conduct vapor intrusion testing of selected houses. This testing is done over the course of a year and will yield for DTSC much new data and a clearer idea how much toxic vapor has come into the neighbors' homes. The PCU reached out to MSNA and DTSC and we will be meeting with the PCU to discuss this later this week. This is important information for the the BOS to consider.

Based on the expert opinions of geologist Don Moore and Lenny Siegel, Executive Director of the Center for Public Environmental Oversight, it is more likely than not that the draft response plan submitted by TNDC will have to be revised after the comment period closes 8/13/21. The draft response plan is downloadable at this DTSC link: <https://www.envirostor.dtsc.ca.gov/public/community_involvement_documents?global_id=60003063&document_folder=+4489225089>

The draft response plan recommends a Vapor Intrusion Mitigation System (VIMS) at a cost of $799k plus $500k for future monitoring costs. (see Draft Response Plan: p. 17; Appendix C p. 2) This is already six times the $120k cost projected by the appraisal, making the appraisal unreliable, among other reasons. However, both Mr. Moore and Mr. Siegel will testify that VIMS is inadequate for dealing with a site like the 2500 Irving Street block where the PCE plume that is under the property extends north under the adjacent homes. There is a reasonable probability that DTSC will recommend their presumptive remedy, Soil Vapor Extraction (SVE) for the contamination at Irving site. (see attached DTSC's document: Proven Technologies and Remedies Guidance: Remediation of Chlorinated Volatile Organic Compound in Vadose Zone Soil)

Both Mr. Moore and Mr. Siegel will testify that the original ESA Phase II recommendation of further neighborhood testing to discover the extent of the plumes and testing to locate the PCE hot spots should be completed before any transfer of ownership for 2550 Irving. They also will testify that with two PCE gas plumes, one of which is underneath 2550 Irving, additional vapor intrusion testing in

individual neighborhood houses is necessary to determine whether PCE gas has entered other buildings besides the Police Credit Union. Mr. Moore will testify that it is not possible without further testing to estimate the total remediation cost. However, with SVE, PCE can be removed from the neighborhood without needing to conduct continued expensive monitoring for years.

If the full Board approves the resolution as submitted, even with disbursement contingent on final DTSC approval of a response plan, it is reasonably probable based on the evidence that the draft response plan will have to be revised. Revising the draft response plan will have an effect on the allocation of responsibility between the Police Credit Union whom I'm meeting with after the BOS meeting on Tuesday, and TNDC.

With this uncertainty affecting financial feasibility of the loan as submitted, it is recommended that the Board defer approval of the resolution until after the testing is completed and a response plan finalized with DTSC.

Paul Holzman
415-706-0618 cell

WATTS, COHN and PARTNERS, INC.

COMMERCIAL REAL ESTATE APPRAISAL

APPRAISAL OF:

2550 IRVING STREET

SAN FRANCISCO, CALIFORNIA

PREPARED FOR:

TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION

SAN FRANCISCO, CALIFORNIA

JUNE 2021

21-WCP-032

WATTS, COHN and PARTNERS, INC.
COMMERCIAL REAL ESTATE APPRAISAL

June 7, 2021

Ms. Katie Lamont
Senior Director of Housing Development
Tenderloin Neighborhood Development Corporation
201 Eddy Street
San Francisco, California 94102

Re: 21-WCP-032 Appraisal
2550 Irving Street
San Francisco, California

Dear Ms. Lamont:

At your request and authorization, Watts, Cohn and Partners, Inc. has made an appraisal of the above referenced property. The subject property appraised consists of a single parcel of land located on Irving Street bounded by 27th and 26th Avenues in the Outer Sunset neighborhood of San Francisco, California. The property has a street address of 2520-2550 Irving Street. The parcel contains approximately 19,125 square feet, or 0.44 acres, of land area. The zoning designation is NCD, Irving Street Neighborhood Commercial, Moderate Scale, with a height limit of 40 feet.

The subject land is presently improved with a two-story wood frame commercial building known as the Police Credit Union that was built in 1966, as well as surface parking. The existing improvements are not consistent with the highest and best use of the site, which is for redevelopment with a more intensive use. As requested by the client, the subject is appraised under the assumption that the subject improvements will be demolished and developed with multifamily housing. The site is identified by the San Francisco County Assessor as Block 1724 Lots 038.

The subject property is currently under contract to be purchased for $9,000,000. This is equal to approximately $471 per square foot. The purchaser is proposing to develop the property with low income rent restricted dwelling units. However, as of the date of value, the property has not submitted for entitlements.

The client has asked that the property be appraised fee simple under the current zoning without consideration of the proposed affordable project. The proposed affordable project is planned for 90 to 100 units in a 7-story building and is only allowed due to Senate Bill 35 in conjunction with the State Bonus Law because it will be a 100 percent rent restricted project. Current city zoning

under the Home-SF Program would allow for an estimated 75-unit mixed use multifamily development of which 70 percent would be market rate units and 30 percent would be BMR units as required by the city. This appraisal addresses the current as-is land value based on the City zoning allowing for a typical profit motivated buyer to develop an estimated 75-units. (The proposed 100 percent affordable project would likely show no residual land value and is therefore not the highest and best use of the subject site).

Over the last year market conditions have changed in response to the Covid-19 pandemic. Many businesses are closed, and unemployment rates have increased. There is some market concern that tenants will be unable to pay their rents in a timely manner. Demand for high density multifamily housing has decreased and there is no consensus at this time as to the direction of the market in the near term. The analysis and value opinion in this appraisal are based on the data available to the appraiser at the time of the assignment and apply only as of the indicated effective date of value.

The property interest appraised is fee simple.

The client for this appraisal is Ms. Katie Lamont, Senior Director of Housing Development with Tenderloin Neighborhood Development Corporation ("TNDC"). The purpose of this appraisal is to estimate the current market value of the fee simple interest in the subject property in its present, physical as-is condition. It is our understanding that the intended use/user for this appraisal is for the exclusive use of TNDC and the City and County of San Francisco for assistance in financing the proposed affordable development. ***This report should not be used or relied upon by any other parties for any reason.***

A more complete description of the subject property appraised, as well as the research and analyses leading to our opinion of value, is contained in the attached narrative report. Chapter I provides a basic summary of salient facts and conditions upon which this appraisal is based and reviews the value conclusion.

VALUE CONCLUSIONS

As-Is Value

Based on the research and analyses contained in this report, and subject to the assumptions and limiting conditions contained herein, it is the opinion of the appraisers that the fee simple market value of the subject property, assuming it is a vacant land development site, as of March 29, 2021, is estimated to be:

NINE MILLION DOLLARS

($9,000,000)

It is the opinion of the appraiser that the above concluded market value for the subject property could be achieved within 12 months of exposure period as of the date of value.

This letter must remain attached to the appraisal report, identified on the footer of each page as 21-WCP-032, plus related exhibits, in order for the value opinion set forth to be considered valid.

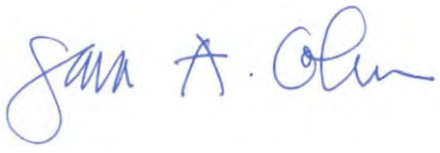
CERTIFICATION

We, the undersigned, hereby certify that, to the best of our knowledge and belief: the statements of fact contained in this report are true and correct; the reported analyses, opinions, and conclusions are limited only by the reported assumptions and limiting conditions, and are our personal, impartial, and unbiased professional analyses, opinions, and conclusions; we have no present or prospective interest in the property that is the subject of this report, and we have no personal interest with respect to the parties involved; we have no bias with respect to the property that is the subject of this report or to the parties involved with this assignment; our engagement in this assignment was not contingent upon developing or reporting predetermined results, our compensation is not contingent upon the reporting of a predetermined value or direction in value that favors the cause of the client, the amount of the value opinion, the attainment of a stipulated result, or the occurrence of a subsequent event directly related to the intended use of this appraisal; the appraisal assignment was not based on a requested minimum valuation, a specific valuation, or the approval of a loan; our analyses, opinions and conclusions were developed, and this report has been prepared in conformity with the Uniform Standards of Professional Appraisal Practice, Code of Professional Ethics and the Standards of Professional Appraisal Practice of the Appraisal Institute, and is in compliance with FIRREA; Sara Cohn has made a personal inspection of the property that is the subject of this report; no one provided significant real property appraisal assistance to the persons signing this report. The use of this report is subject to the requirements of the Appraisal Institute related to review by its duly authorized representatives. As of the date of this report Sara Cohn has completed the requirements under the continuing education program of the Appraisal Institute. In accordance with the Competency Rule in the USPAP, we certify that our education, experience and knowledge are sufficient to appraise the type of property being valued in this report. We have not provided services regarding the property that is the subject of this report in the 36 months prior to accepting this assignment.

We are pleased to have had this opportunity to be of service. Please contact us if there are any questions regarding this appraisal.

Sincerely,

WATTS, COHN and PARTNERS, INC.



Sara Cohn, MAI
Certified General Real Estate Appraiser
State of California No. AG014469

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ADDENDA

Preliminary Title Report
Purchase Contract
Preliminary Title Report
Qualification and License of Appraisers

I. REPORT SUMMARY

A. Property Appraised

The subject property appraised consists of a single parcel of land located on Irving Street bounded by 27th and 26th Avenues in the Outer Sunset neighborhood of San Francisco, California. The property has a street address of 2520-2550 Irving Street. The parcel contains approximately 19,125 square feet, or 0.44 acres, of land area. The zoning designation is NCD, Irving Street Neighborhood Commercial, Moderate Scale, with a height limit of 40 feet.

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Over the last year market conditions have changed in response to the Covid-19 pandemic. Many businesses are closed, and unemployment rates have increased. There is some market concern that tenants will be unable to pay their rents in a timely manner. Demand for high density multifamily housing has decreased and there is no consensus at this time as to the direction of the market in the near term. The analysis and value opinion in this appraisal are based on the data available to the appraiser at the time of the assignment and apply only as of the indicated effective date of value.

The property interest appraised is fee simple.

B. Property Identification

Assessor's Parcel Nos.	Block 1724 Lot 038
Zip Code	941122-1515
Zoning	NCD
Census	326.02
Flood Zone *(Insurance Not Required*	Zone X

C. Client, Purpose, Intended Use and Intended User

The client for this appraisal is Ms. Kate Lamont, Senior Director of Housing Development with Tenderloin Neighborhood Development Corporation ("TNDC"). The purpose of this appraisal is to estimate the fee simple market value of the property as a vacant land development site. It is our understanding that the intended use/user for this appraisal is for the exclusive use of TNDC and the City and County of San Francisco, for assistance in the financing the proposed affordable development. ***This report should not be used or relied upon by any other parties for any reason.***

D. Scope of Work

The scope of this narrative appraisal report is to utilize the appropriate standard approaches to value in accordance with Uniform Standards of Professional Appraisal Practice (USPAP) to arrive at our market value conclusion. Specific steps include the inspection of the subject property, and the research and analysis of comparable data.

The Sales Comparison Approach is the most reliable indicator for the subject. The Cost and Income approaches lack relevance for properties like the subject, where the highest and best use is for redevelopment.

E. Reporting Format

This is an Appraisal Report in a narrative format. This report is intended to be an Appraisal Report prepared in conformance with USPAP Standard 2-2(a).

F. Date of Appraisal and Date of Report

The effective date of valuation is March 29, 2021.

The date of this report is June 7, 2021.

G. Definition of Terms

1. Market Value (OCC 12 CFR 34.42 (g)) (OTS 12 CFR, Part 564.2 (g))

"Market value" means the most probable price which a property should bring in a competitive and open market under all conditions requisite to a fair sale, the buyer and seller, each acting prudently, knowledgeably and assuming the price is not affected by undue stimulus. Implicit in this definition are the consummation of a sale as of a specified date and the passing of title from seller to buyer under conditions whereby:

a. Buyer and seller are typically motivated;

b. Both parties are well informed or well advised, and acting in what they consider their own best interests;

c. A reasonable time is allowed for exposure in the open market;

d. Payment is made in terms of cash in US dollars or in terms of financial arrangements comparable thereto; and

e. The price represents the normal consideration for the property sold unaffected by special or creative financing or sales concessions granted by anyone associated with the sale.

2. Fee Simple Interest (The Appraisal of Real Estate, 13th Edition, 2008)

A fee simple interest in valuations terms is defined as "…absolute ownership unencumbered by other interest or estate, subject only to the limitations imposed by governmental powers of taxations, eminent domain, police power, and escheat."

H. Value Conclusion

Based on the research and analyses contained in this report, and subject to the assumptions and limiting conditions contained herein, it is the opinion of the appraisers that the fee simple market value of the subject property, assuming it is a vacant land development site, as of March 29, 2021, is estimated to be:

NINE MILLION DOLLARS

($9,000,000)

It is the opinion of the appraiser that the above concluded market value for the subject property could be achieved within 12 months of exposure period as of the date of value.

I. Assumptions and Limiting Conditions

General Limiting Conditions

1. It is the client's responsibility to read this report and to inform the appraiser of any errors or omissions of which he/she is aware prior to utilizing this report or making it available to any third party.

2. No responsibility is assumed for legal matters. It is assumed that title of the property is marketable and it is free and clear of liens, encumbrances and special assessments other than as stated in this report.

3. Plot plans and maps are included to assist the reader in visualizing the property. Information, estimates, and opinions furnished to the appraiser, and contained in the report, were obtained from sources considered reliable and believed to be true and correct. However, no responsibility for accuracy of such items furnished the appraisers is assumed by the appraisers.

4. All information has been checked where possible and is believed to be correct but is not guaranteed as such.

5. The appraiser assumes that there are no hidden or unapparent conditions of the property, subsoil, or structures, which would render it more or less valuable. The appraiser assumes no responsibility for such conditions, or for engineering which might be required to discover such factors. It is assumed that no additional soil contamination exists, other than as outlined herein, as a result of chemical drainage or leakage in connection with any production operations on or near the property.

6. In this assignment, the existence (if any) of potentially hazardous materials used in the construction or maintenance of the improvements or disposed of on the site has not been considered. These materials may include (but are not limited to) the existence of formaldehyde foam insulation, asbestos insulation, or toxic wastes. The appraiser is not qualified to detect such substances. The client is advised to retain an expert in this field.

7. Any projections of income and expenses in this report are not predictions of the future. Rather, they are an estimate of current market thinking of what future income and expenses will be. No warranty or representation is made that these projections will materialize.

8. The appraisers are not required to give testimony or appear in court in connection with this appraisal unless arrangements have been previously made.

9. Possession of this report, or a copy thereof, does not carry with it the right of publication. It may not be used for any purpose by any person other than the party to whom it is addressed without the written consent of the appraisers, and in any event only with the proper written qualification, only in its entirety, and only for the contracted intended use as stated herein.

10. Neither all nor part of the contents of this report shall be conveyed to the public through advertising, public relations, news sales, or other media without the written consent and approval of the appraiser, particularly as to the valuation conclusions, the identity of the appraiser, or any reference to the Appraisal Institute or the MAI designation.

11. Information regarding any earthquake and flood hazard zones for the subject property was provided by outside sources. Accurately reading flood hazard and earthquake maps, as well as tracking constant changes in the zone designations, is a specialized skill and outside the scope of the services provided in this appraisal assignment. No responsibility is assumed by the appraiser in the misinterpretation of these maps. It is strongly recommended that any lending institution re-verify earthquake and flood hazard locations for any property for which they are providing a mortgage loan.

II. AREA AND NEIGHBORHOOD DESCRIPTION

A. San Francisco and the Bay Area

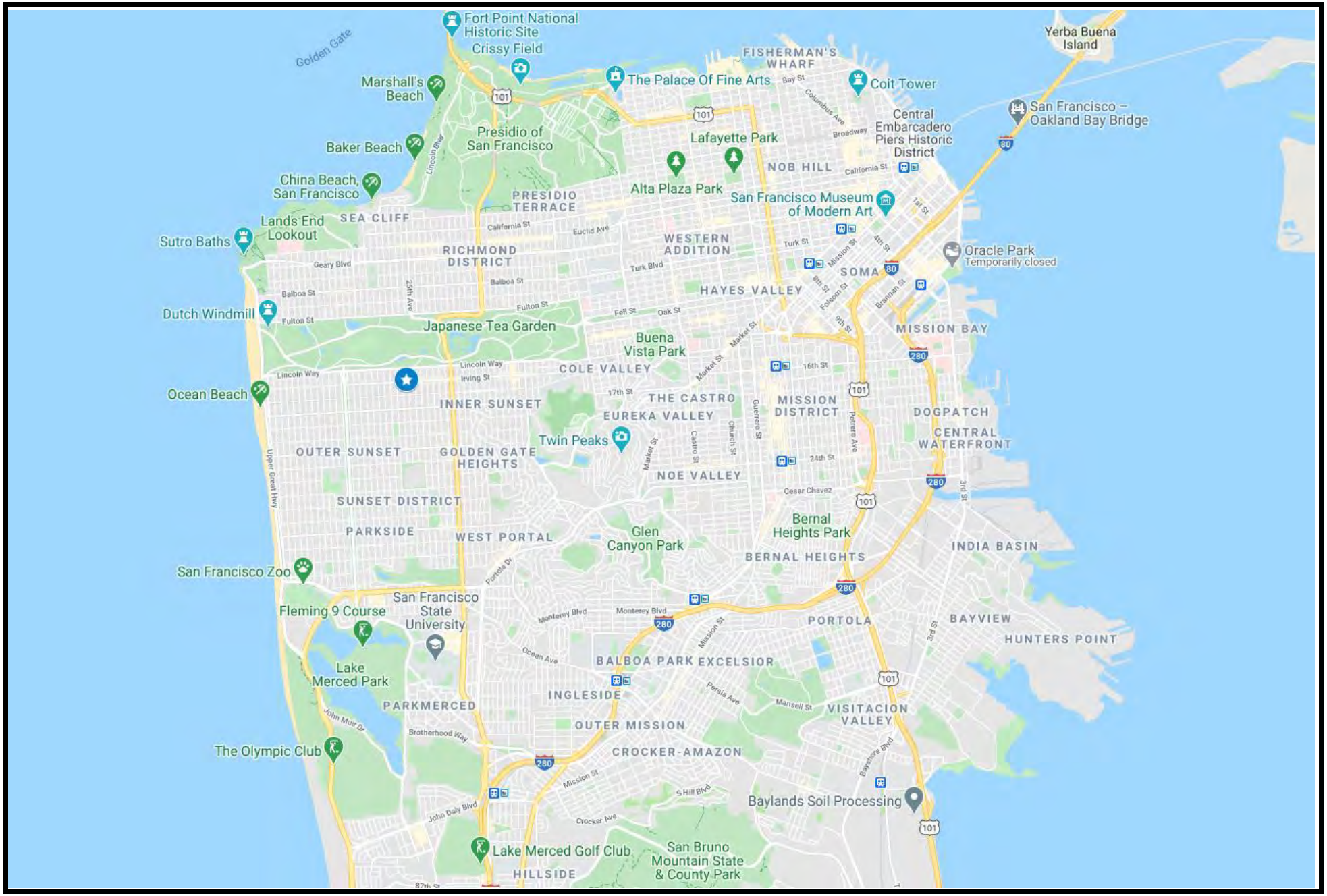
While San Francisco covers a relatively small land area of approximately 45 square miles, it is the geographic center of a major metropolitan area consisting of nine counties surrounding San Francisco Bay. The Bay Area is the fifth largest metropolitan center in the United States with a population exceeding 7,100,000. It has a relatively stable economic base which will likely expand in the future. Principal economic activities include finance, high technology, manufacturing, and transportation. The population within San Francisco proper was approximately 897,806 as of January 1, 2020 according to estimates prepared by the California Department of Finance. This is a 0.8 percent increase from the previous year. ABAG predicts that the total population will be 999,750 by 2025 and will increase to 1,034,175 by 2030, a 17 percent increase over the next ten years.

The California Employment Development Department reports San Francisco's unemployment at 5.7 percent as of February 2021 (most recent available), up from 2.2 percent the previous year. The state unemployment rate was 8.4 percent, up from 4.3 percent a year prior. As of the effective date of this appraisal, published reports state that unemployment insurance claims in San Francisco and California have risen significantly since March 2020 due to the Covid-19 pandemic. As of September 2020, it has been reported that in the State of California 2,801,538 million people are certified for unemployment benefits. This figure is down from the previous month by 35,671 people, but up from a total of 281,060 people in September 2019.

The largest employment sector in San Francisco are financial and professional services with approximately 324,360 jobs, which accounts for approximately 41 percent of total jobs in San Francisco. This is forecast to increase to 344,500 by 2025, and 355,895 by 2030. The second largest employment sector, at 29 percent of total jobs, is health, educational and recreational services, with 228,350 jobs forecast for 2020. This is expected to increase to 243,335 in 2025 and to 246,540 in 2030. Information, Government and Construction jobs comprise of approximately 19 percent of the total jobs, and this sector is forecast to increase to approximately 151,515 jobs by 2025, and 164,730 by 2030. These three sectors comprise approximately 89 percent of total jobs in San Francisco. According to the U.S. Census American Community Survey 2018 1-Year Estimates, San Francisco’s median household income was $112,376.

Overall, the economic outlook for San Francisco and the Bay Area is generally favorable. On a regional basis, the Bay Area has a diversified economic base which helps insulate it from national economic fluctuations. Employment patterns within San Francisco are generally oriented toward office and tech industry activities. These activities, as opposed to functions such as heavy industry, have traditionally been less vulnerable to changes in the business cycle.

REGIONAL MAP



B. Neighborhood Description

The subject is located in the Outer Sunset neighborhood of San Francisco. The Outer Sunset refers the portion of the greater Sunset neighborhood to the west of 19th Avenue. The neighborhood is roughly bounded by Lincoln Way to the north, 19th Avenue to the east, Rivera Street to the south, and the Great Highway/Ocean Beach to the west.

Originally sand dunes, the Outer Sunset neighborhood is now characterized by its rows of 1920 and 1950s era single family housing stock, built en masse by developers to take advantage of the new FHA loans. Outer Sunset housing is relatively uniform, and the neighborhood is almost suburban in nature. Commercial uses are generally grouped along the east-west corridors in multi-block neighborhood commercial centers.

The main north-south thoroughfare is 19th Avenue, also known as Highway 1, which connects the City to the Golden Gate Bridge and Marin to the north, as well as the Coastal Highway to the south. Other neighborhood north-south arteries include Sunset Boulevard (between 36th and 37th Avenues), and the Great Highway by Ocean Beach. The main east-west route through the neighborhood is Lincoln Way to the north. The rest of the east-west streets are generally smaller, with multiple pedestrian crossings and stop signs, making east-west travel slower in general.

Public transportation in this neighborhood is limited in comparison to the eastern half of the City. The Sunset is not served by BART, which serves the greater Bay Area, limiting commuter public transportation options. The main light rail line in the neighborhood is the N-Judah, which runs from Ocean Beach to the Embarcadero.

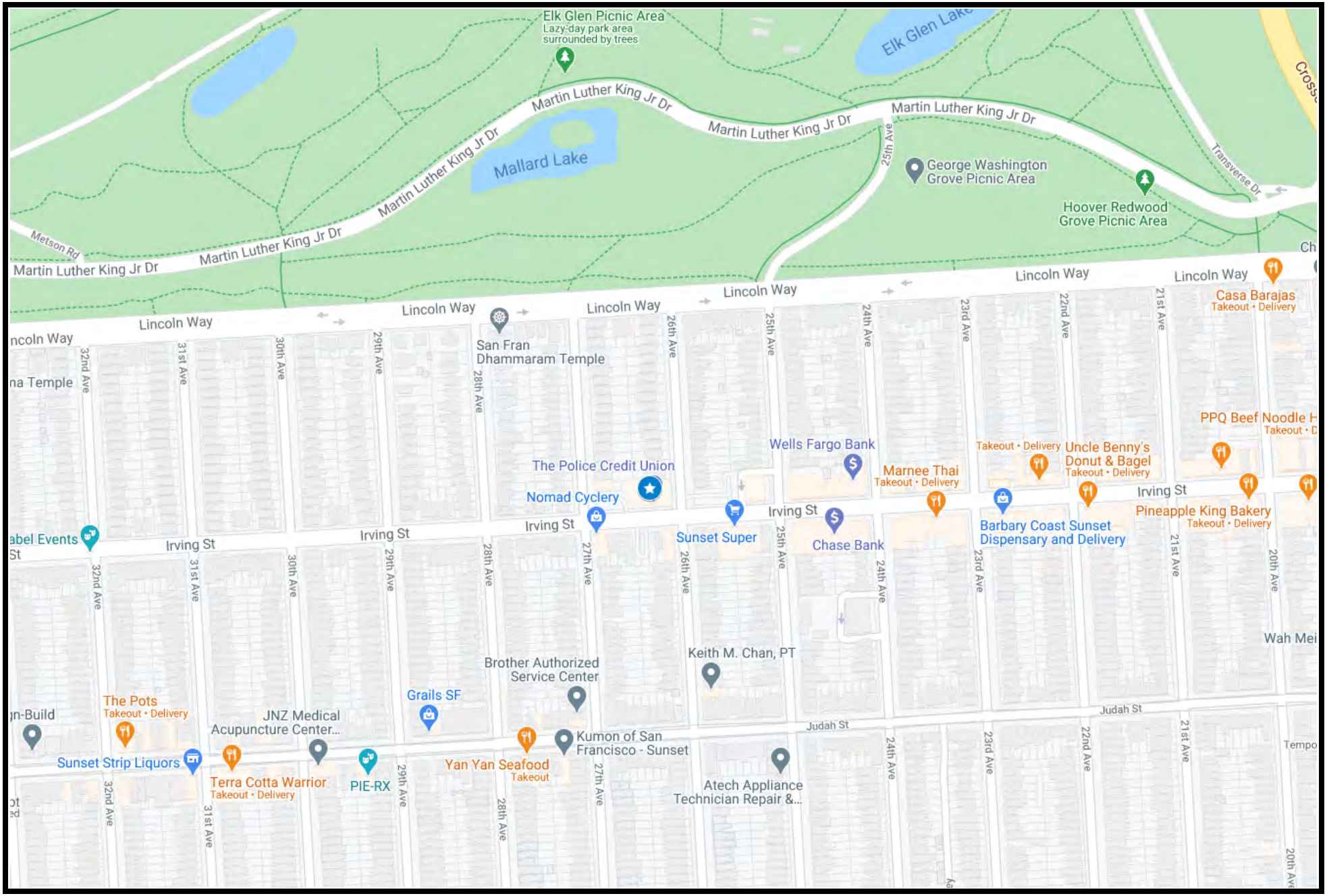
The subject is located toward the western boundary of a neighborhood commercial strip on Irving Street that begins at 16th Avenue and continues across 19th Avenue going westwards until about 26th Avenue. The commercial strip along Irving Street in the subject's immediate vicinity is dominated by restaurants, medical offices, grocery stores, bars, snack shops, and variety of other retail uses. The smaller buildings tend to be older residences or mixed-use buildings with commercial use on the ground floor and upper level residential and office uses.

The neighborhood is generally mature but is also undergoing some redevelopment and renovation. The subject is located in a desirable and well-established commercial location that is convenient to public transportation and shopping.

C. Immediate Environs

The subject is located on Irving Street and also has frontage on 26th and 27th Avenues in the Outer Sunset District. The avenues north and south of Irving Street

NEIGHBORHOOD MAP



are mostly comprised of residential uses, both single and multifamily. One block north of the subject across Lincoln Way is Golden Gate Park, San Francisco's largest public park. One block south is Judah Street, and the nearest MUNI light rail line.

Across the street from the subject are two- and three-story mixed-use buildings and a parking lot. The ground level commercial uses across Irving Street include a bicycle store, several offices, and a bank branch. Sunset Super is half a block east of the subject and is the largest grocery store in the neighborhood. Restaurant and snack shops are prevalent in the subject commercial strip, as are bank branches and convenience stores.

The subject's Walkscore (www.walkscore.com) is 90 (Walker's Paradise). Walkscore is a 100-point scale that rates proximity to various amenities such as shopping, dining, schools, and services. The Transit Score is 56 (Good Transit), and the Bike Score is 87 (Very Bikeable).

Overall, the subject neighborhood is dominated by a mix of commercial and low-rise residential uses. The proximity to public transportation and commercial uses suggests that the subject neighborhood is well suited for a variety of mixed-use, institutional, or residential uses. The overall outlook for this area, for both residential and commercial uses, is positive.

III. MARKET DISCUSSION

A. Residential Market Overview

Historically, strong demand and high barriers to entry have kept San Francisco housing prices at roughly two times the national average. In recent years, the tech industry has triggered strong demand for housing in San Francisco, as well as the larger Bay Area. San Francisco rental projects had been reporting record rental rates, surpassing Manhattan as the most expensive in the nation. The for-sale market had also improved significantly over the past couple of years, observing record high sale prices up until 2020. The historic high demand is due to several factors including lack of available land, high construction costs, and strict regulations regarding new development. These factors resulted in a continually low annual production of housing units relative to demand. Despite San Francisco's sound fundamentals, the current economic downturn due to Covid-19 pandemic is having significant impacts on both pricing and sale volume of residential units within the city.

The San Francisco residential market came to a near standstill in March 2020, when shelter-in-place and social distancing orders were put into effect by local and state governments. The San Francisco Association of Realtors (SFAR) reported a dramatic decrease in listings from 2019, as people withdrew their homes from the market and began sheltering in place. According to a February 2021 market report prepared by Compass, "Of Bay Area counties, San Francisco was most negatively affected in the months immediately following the implementation of shelter-in-place. Inventory soared and sales plunged, especially in its condo market. In the second half of the year, buyers rushed back into the market. Sales volume, very unusually, peaked for the year in December, hitting its highest point in history (for December). Home sales in January were up 67% over January 2020, a tremendous increase. Year-over-year, house median sales prices are up a little, and condo median prices, divided by size of unit, were down about 10%. The city remains a very complex market, varying by neighborhood, property type and price segment. And vaccines may alter dynamics considerably in 2021."

With the current Covid-19 pandemic, has been some uncertainty in the multifamily residential market. The availability of capital may be limited in the short term. However, San Francisco has a chronic shortage of housing that will most likely support demand despite the economic uncertainties, given its generally strong tech employment base. Any effect on the housing market will most likely be due to a global recession, which is expected to be tempered by the chronic under-supply of housing in San Francisco. However, multifamily is expected to be less risky than other types of commercial properties and is expected to recover faster from the current Covid-19 recession.

B. Housing Supply and Demand

The following is a discussion of the current housing supply and demand trends in San Francisco. According to the city's most recent Housing Element, the Association of Bay Area Governments (ABAG) allocated about 29,000 new housing units in the City and County of San Francisco through the year 2014 - 2022, with over 57 percent of those units required to be affordable to households of moderate income (defined as 120 percent of Area Median Income) or below. This corresponds to ABAG's Projections 2040, which projects that the number of households in San Francisco is projected to increase from 408,600 in 2020 to 437,505 by 2030. This indicates an average housing demand of approximately 29,000 units over the 10-year period. Applied to the 2014 - 2022 planning period, this is equivalent to approximately 3,625 units per year, over an eight-year period.

In addition, according to the 2019 American Community Survey: 1-Year Estimates, the homeownership rate in San Francisco is 37.6 percent of total occupied units, indicating a rental rate of 62.4 percent. Applying this to the ABAG 2014 - 2022 projection indicates an annual rental housing demand of approximately 2,266 rental units per year.

As of October 2020 (most recent available), the San Francisco Planning Department reports that there are a total of 72,565 net new units in the development pipeline. Of those units, 9,497 are under construction; 8,156 have been approved for building permits; 2,725 have filed for building permits; 1,895 have not yet filed for building permits; and 31,016 are major multi-phased projects that are still in progress and represent the remaining phases of those projects. Currently 17,129 units are undergoing the entitlement process and have filed applications.

2020 Q2 Housing Development Pipeline		
	Net Units	*% of Total*
Total Units	70,418	100%
Affordable Units	13,907	20%
Entitled		
Under Construction	9,497	13%
Building Permits Approved	8,156	12%
Building Permits Filed	2,725	4%
Building Permits Not Yet Filed	1,895	3%
Major Multi-Phased Projects	31,016	44%
Under Review		
Applications Filed	17,129	N/A

Major projects which recently received approvals include 2,700 units in the Potrero Power Plant proposed development. The proposed development at Balboa

Reservoir is currently seeking approvals for 1,300 units. However, it is highly unlikely all of these units will be built, as the market cycles, financing availability and competition among projects will effectively limit the number of projects that will actually be constructed.

Based on the existing supply in the pipeline, there is a relatively large quantity of new product planned and/or under construction in this market, so there is some risk of oversupply. However, market demand has proven to be far stronger than anticipated prior to 2020, in virtually all product strata. The chronic under-supply condition of the San Francisco housing market does not fully insulate it from the vagaries of future market fluctuations, but it does bode well for the long-term health of the market. Nonetheless, with the downturn in the economy new projects could face challenges given the tighter credit markets, concerns over job stability and social distancing limits.

C. Factors Affecting Proposed Residential Development in San Francisco

San Francisco Inclusionary Housing Program

San Francisco ***Inclusionary Housing Program*** was implemented in 2002. Any new residential projects with 10 or more units must include on-site or off-site affordable units. Developers also have an option to pay an affordable housing fee, also known as an "in-lieu fee".

The current inclusionary housing requirements for small rental/ownership projects between 10 and 24 dwelling units, is 14 percent for on-site and 24 percent for off-site housing or in-lieu payment. For projects over 25 units the current on-site requirements for rental housing is 21 percent and 23 percent for-sale housing. The off-site affordable or fee equivalent is 30 percent for rental and 33 percent for-sale housing. The on-site percentages increase by 0.5 percent on an annual basis until the maximum of 15 percent is attained for smaller properties. For projects over 25 units the maximum will be 24 percent for rental housing and 26 percent for ownership housing.

San Francisco Affordable Housing Programs

The City of San Francisco offers developers the ability to utilize the State Density Bonus Law and local density programs for mixed income residential projects.

The ***Home-SF Program*** requires that the project must include 30 percent or more affordable housing units on-site. Of the 30 percent, 12 percent must be affordable to low- and moderate-income households and 18 percent must be affordable to middle income households. Projects including 30 percent affordable units are able to build more residential units and up to an additional two stories than currently allowed under zoning. Two-bedroom units must make up 40 percent of the total

number of housing units. This program does not have a minimum housing unit threshold and projects are exempted from density limits.

The ***Individually Requested State Density Bonus Program*** must include 12 percent on-site affordable housing and up to an additional 8 percent affordable units (a combination of very low-, low- and moderate-income units). This path allows developments to achieve a 7 to 35% density bonus over the permitted base zoning, and up to two additional stories, but only when it is necessary to accommodate increased density. Projects may seek up to three incentives and concessions and unlimited waivers from site development standards. The city also requires that the extra units entitled through the State Bonus Density law must pay an additional affordable housing fee.

The ***Analyzed State Density Bonus Program*** is a local density program that serves as an alternate to the Individually Requested Density Bonus Program. Projects are eligible for a density bonus up to 35% percent depending on the amount of affordable housing provided and level of affordability. The developer may choose from a pre-determined list of waivers, incentives and concessions. This program requires a Conditional Use Authorization from the Planning Commission.

California Senate Bill 35

The California Senate Bill 35 (SB 35) was signed into law on September 29, 2017 by Governor Brown. The bill was introduced to increase housing supply in cities which were not producing enough housing by encouraging cities to either increase housing development on their own or be forced to accept housing development. It allows the developers to submit an application to streamline the approval process in cities that do not meet Regional Housing Needs Assessments (RHNA). Reportedly, approximately 98 percent of California cities and counties fall under the provisions.

The development must designate at least 10% of the units as below market housing if located in areas that did not meet above moderate income RHNA. When jurisdictions have made insufficient progress towards their Lower Income RHNA (Very Low and Low Income) they are subject to streamlining for proposed development with at least 50% affordability. Other requirements include: that it must be multifamily housing, the construction workers must be paid union level wages and the property not be constructed in an ecologically protected area. If the development meets all the state mandated criteria, the localities must approve the project in 60 days if the development contains less than 150 housing units, or 90 days if the development contains more than 150 units of housing.

The SB 35 requires local entities to streamline the approval of certain housing projects. It is used in conjunction with State Density Bonus Program. Qualifying projects are entitled to receive certain zoning modifications as well as density bonus, height increases and streamlined approvals. Projects that are proposed to be

100% affordable, under the State Density Bonus Law, are allowed an 80% density bonus over the permitted base zoning. In addition, there is no maximum density if a project is located within one-half mile of a major transit stop. Projects may also qualify for three additional stories, per AB-1763.

D. Apartment Rental Market

The city of San Francisco has traditionally been one of the most expensive housing markets in the country. The strength of the market has been largely fueled by the migration of technology companies to San Francisco. The substantial demand for housing, particularly for apartments, has led to the increased speculative residential construction.

The City of San Francisco's multifamily apartment market is still weathering the effects of the Covid-19 pandemic, the long-term effects of which are still currently unknown. According to CoStar's Multi-Family Market Report for San Francisco dated February 2021: "Beyond the emerging threat that a shift to remote-based work poses to expensive markets like San Francisco, immediate job losses are plaguing the apartment market. Employment in retail, hospitality, restaurants, and entertainment venues has been devastated. The loss of so many jobs combined with an exodus resulting from a rise in mobile-based work has led to a substantial outflow of apartment renters. Demand for apartments is projected to weaken further over the next few quarters as furloughed renters and those with lost income streams struggle to renew leases."

The subject is located within the Costar Sunset/Lakeshore multifamily submarket. This submarket is bordered by Lincoln Way and Golden Gate Park to the north, the Pacific Ocean to the west, I-280 and the City's southern border to the south, and Glen Canyon/Twin Peaks/Cole Valley to the east.

Rents

According to CoStar's Multi-Family data for San Francisco dated April 2021: "Without the restaurants, nightlife, shops, museums, and parks that make San Francisco a desirable live/work/play environment, its high cost of living was no longer worth it for some with the ability to relocate. Renters working from home were attracted to more suburban, outdoor-friendly areas, and some younger millennials moved back home, at least temporarily. Job losses also plagued the apartment market. Employment in retail, hospitality, restaurants, and entertainment venues has been devastated. The loss of so many jobs combined with an exodus resulting from a forced adoption of remote work led to a substantial outflow of apartment renters in 2020. The trajectory of the market in 2021 will largely depend on how many renters come back when offices reopen, and how quickly the draws of a large vibrant city are restored. Distribution of the coronavirus vaccine and plans to reopen offices in the late summer and fall has already ushered back some

apartment rental demand." The following table tracks market rents as reported by CoStar for San Francisco and the subject submarket.

San Francisco Asking Rents			
Unit Type	Rent as of 4/5/2021	Rent as of 4/5/2020	% Change
All Types	**$2,786**	**$3,082**	**-9.6%**
Studio	$1,982	$2,257	-12.2%
1 BD	**$2,520**	**$2,798**	**-9.9%**
2 BD	$3,356	$3,692	-9.1%
3 BD	**$4,976**	**$5,238**	**-5.0%**

Sunset/Lakeshore Submarket Asking Rents			
Unit Type	Rent as of 4/5/2021	Rent as of 4/5/2020	% Change
All Types	**$3,009**	**$3,022**	**-0.4%**
Studio	$1,986	$2,461	-19.3%
1 BD	**$2,429**	**$2,597**	**-6.5%**
2 BD	$3,700	$3,361	10.1%
3 BD	**$5,055**	**$5,043**	**0.2%**

In the subject submarket, rents are above the citywide average. Market asking rents for all unit types in the City of San Francisco was reportedly $2,786, while the submarket asking rent was approximately $3,009 per month. As reported by CoStar, "Sunset/Lakeshore has been plagued by move-outs during the pandemic, exasperated by job losses and campus closures. Vacancy was more than 12% at the end of 2020 and continued to climb higher in early 2021. Asking rents are declining sharply in response to weakening submarket fundamentals, underperforming the market average. Rental demand in the Sunset is historically boosted by unique cultural amenities, educational institutions, and the presence of major employers, but without full access to many of these destinations, some renters have fled the area."

The submarket's average rent is bolstered by the popular and affluent neighborhoods of Cole Valley and West Portal. To account for the discrepancy in asking rents, the table below presents asking rents for all unit types in the subject's Inner Sunset neighborhood, as of April 6, 2021, according to Zumper.com. Zumper.com analyzes its own active inventory to find trends in rent prices and updates the data in real time.

Zumper: Inner Sunset Median Asking Rents			
Unit Type	Rent as of 4/6/2021	Rent as of 4/6/2020	% Change
Studio	$1,913	$2,287	-16.4%
1 BD	$2,525	$2,737	-7.7%
2 BD	$2,948	$3,462	-14.8%
3 BD	$3,800	$4,812	-21.0%
4 BD	$9,495	N/A	N/A

The subject is located within Zumper's Inner Sunset neighborhood. As shown on the chart, Zumper asking rents are slightly lower than the CoStar average but are roughly in line with the CoStar submarket.

Vacancy

CoStar tracks approximately 9,066 units across 502 existing buildings in the subject submarket. Reportedly approximately 1,800 of these units are currently vacant, equating to a vacancy rate of 19.5 percent in the subject submarket, a year-over-year increase of approximately 13.4 percent. This is higher than the San Francisco vacancy rate of 11.5 percent. Historically, limited quantities of new supply in the subject neighborhood kept vacancy rates relatively steady, but job losses and campus closures have exasperated the vacancy in the greater market and submarket.

Vacancy rates have increased due to the impacts of Covid-19. As unemployment rates rise and the economy is affected by the recession, many will become unable to afford their apartments. In March 2020, San Francisco introduced an eviction ban to prevent widespread displacement during the shelter in place orders. Under the current Covid-19 eviction ban, renters are granted a 30-day moratorium with up to six possible 30-day extensions in order to pay any back rent. Should they fail to pay the back rent in that amount of time, they could be subject to an eviction. As of December 2020, it was reported that the San Francisco Board of Supervisors was planning on introducing legislation that would bar all Covid-19 related evictions for the long term. Under the new proposed legislation, renters would still be subject to paying back rent, but landlords "could never remove the tenants over debts specifically related to the novel coronavirus shutdown." [SF Curbed] There is some anticipation of general migration due to Covid-19 however, it will be as an effect due to job loss, and not necessarily eviction. Overall, multifamily is expected to be less risky than other types of commercial properties and recover faster from the current Covid-19 recession.

Additional statewide rent control measures to counteract mass displacement by Covid-19 include Gavin Newsom's statewide pandemic protection. Enacted August 31, 2020, "Under the legislation, no tenant can be evicted before February 1, 2021 as a result of rent owed due to a COVID-19 related hardship accrued between March 4 – August 31, 2020, if the tenant provides a declaration of hardship according to the legislation's timelines. For a COVID-19 related hardship that accrues between September 1, 2020 – January 31, 2021, tenants must also pay at

least 25 percent of the rent due to avoid eviction. Tenants are still responsible for paying unpaid amounts to landlords, but those unpaid amounts cannot be the basis for an eviction. Landlords may begin to recover this debt on March 1, 2021, and small claims court jurisdiction is temporarily expanded to allow landlords to recover these amounts. Landlords who do not follow the court evictions process will face increased penalties under the Act."

On January 25, 2021, Governor Newsom issued a statement extending the current eviction moratorium through to June 31, 2021.

E. Investment Market

The investment market in San Francisco has traditionally been one of the strongest in the nation. Investors are primarily focusing on core, institutional-quality assets with low levels of risks, and especially those in primary markets where real estate recovery is typically faster.

In the San Francisco multifamily market, approximately 136 properties sold in the last twelve months, a 66 percent decrease from one year ago, as of April 6, 2021. The average market sale price per unit was $590,000, a 7.9 percent decrease from a year prior. This equates to a twelve-month sales volume of $1.2 billion, which is a 61 percent decrease from one year ago, at a market cap rate of approximately 3.7 percent. The cap rate increased from 3.5 percent one year ago.

In the subject submarket, a reported 9 properties sold in the past twelve months, a significant 75 percent decrease from a year prior. The average market sales price decreased slightly by 10 percent, to approximately $526,000 per unit, which is significantly lower than the citywide average price per unit. This equates to a twelve-month sales volume of approximately $21.5 million, another significant decrease from the year previous, at a cap rate of 3.9 percent, which is an increase from 3.72 percent a year prior and higher than the city average.

While the coronavirus has created an uncertain future for investors, buyers have always been attracted to San Francisco's sound fundamentals and growth prospects. Due to the chronic undersupply of housing, demand will almost always outweigh supply in the long term. As CoStar notes, "Asset pricing rose to historic levels during the expansion cycle based on the market's sound fundamentals and strong historical rent growth, but pricing is now on the downswing in conjunction with rent potential. The majority of institutional investors in the US continue to target global gateway cities like San Francisco though. Furthermore, private buyers are competing for properties as the cost of capital remains relatively low and value-add deals still provide opportunities for attractive returns. Cap rates remain among the lowest among all markets in the country. However, with restrained credit conditions and reduced volume, cap rates are finally facing slight upward pressures."

F. Conclusion

The Covid-19 Pandemic appears to be having a generally detrimental effect on the San Francisco housing market. However, San Francisco's chronic housing shortage and rent control should hopefully prove to be some insulation against the drop in the rental housing market. Furthermore, San Francisco city leaders, as well as many local landlords, are currently working to minimize the impact the coronavirus will have on the housing market. Costar notes, "The trajectory of San Francisco's economy and commercial real estate markets will depend on how widely the virus spreads how long containment policies like social distancing need to be maintained, and how quickly those with lost jobs can find employment again. On the positive side, Oxford Economics projects that San Francisco's economic recovery will outpace most other markets due to its industry makeup."

In conclusion, the underlying fundamentals in San Francisco, including strong demand and high barriers to development, should help the city fare better than other parts of the country. However, a cautious attitude is warranted due to the uncertainty of the economy and markets in general. It is likely that economic conditions will continue to impact the for-sale and rental markets if layoffs continue.

G. Exposure Period

The exposure period is defined as "the estimated length of time the property interest being appraised would have been offered on the market prior to the hypothetical consummation of a sale at market value on the effective date of the appraisal." Thus, it is assumed to have occurred prior to the appraisal date. In contrast the marketing period is the estimated time that it would take to consummate the sale after the appraisal date.

To allow for adequate marketing and negotiating time and the closing of escrow, an exposure period for the subject is estimated at 12 months.

IV. PROPERTY DATA AND ANALYSIS

A. Site Description

The subject property consists of a single assessor parcel located at the with a street address of 2550 Irving Street, in the Sunset District neighborhood of San Francisco, California. The site is generally rectangular in shape with a notch removed at the western side of the parcel. The property has frontage on three streets: 240 feet Irving Street, 60 feet on 27th Avenue and 90 feet on 26th Avenue. The total site area is approximately 19,125 square feet, or 0.44 acres. The street address is 2550 Irving Street and it has a legal address of 2520 Irving Street. The property is identified by the San Francisco County Assessor as Block 1724 Lot 038.

Topography of the site is generally level. A soil report was not available for review by the appraisers. The precise nature and condition of the subsurface soils is not known. However, judging from the condition and appearance of the subject improvements as well as the developments on surrounding properties, it is assumed that soil conditions are satisfactory for the construction of conventional building improvements.

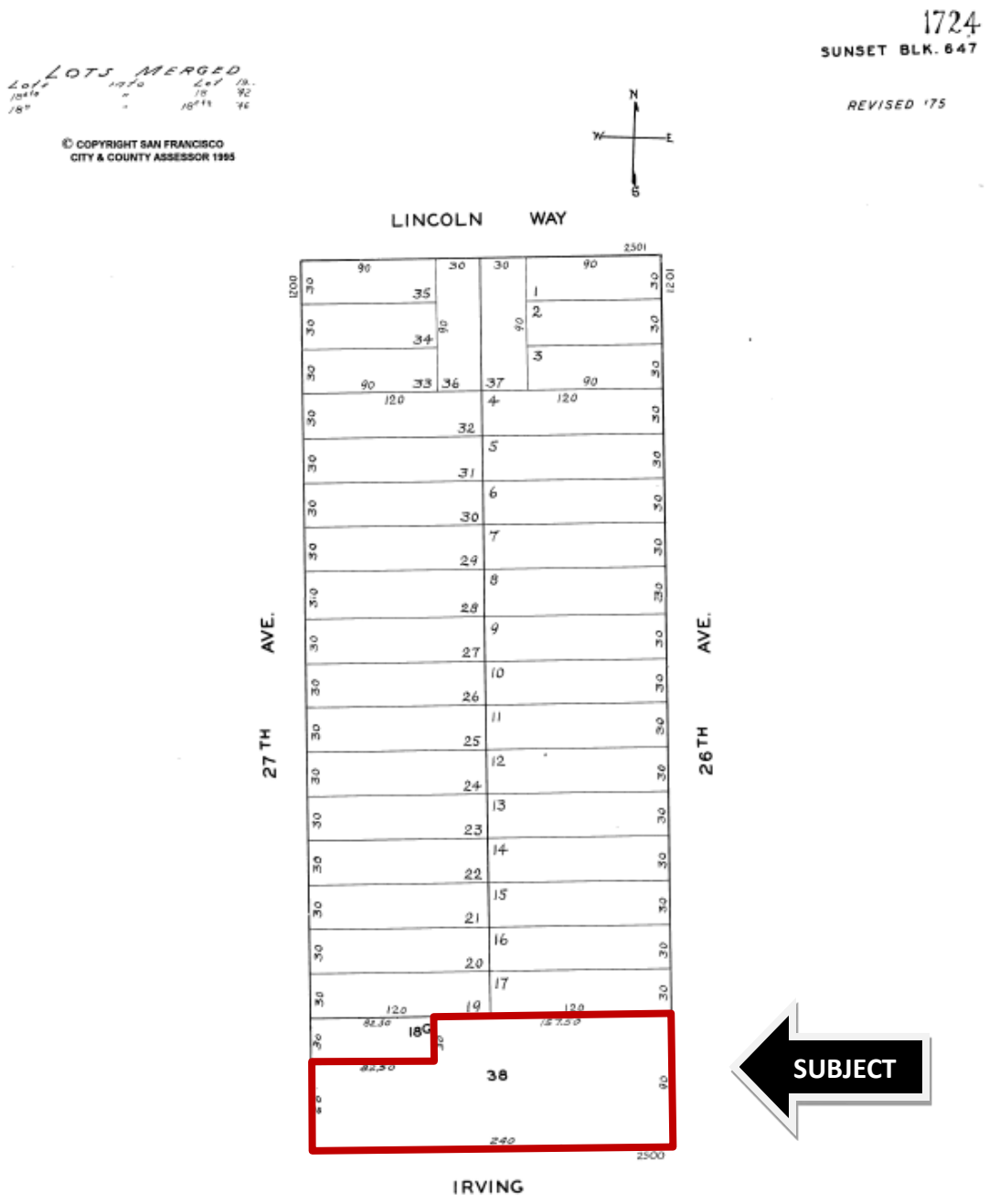
The property is served with typical urban utilities, including public water and sewer systems. Local companies supply electricity, gas and telephone service. The neighboring streets are fully paved and contain sidewalks, curbs, gutters and street lighting.

The site is presently improved with a two-story building commercial building known as Police Credit Union and was built in 1966, as well as surface parking lot that is paved. Based on public records, the building improvements contain approximately 18,561 square feet. The improvements are situated at the central and western portion of the site, fronting Irving Street and 26th Avenue. As discussed in the following chapter, the existing improvements represent an underutilization of the site. The highest and best use is for redevelopment to a more intensive use.

B. Environmental Observations

Upon inspection of the subject site, the appraiser did not observe any toxic contamination on the property. The Third Amendment to the purchase and sale agreement, dated July 24, 2020 indicates that the buyer is contributing $50,000 towards the cost of the environmental studies to be performed by AllWest Environmental, Inc. and Haley & Aldrich, Inc. on and around the property. There is also an estimated $120,000 in environmental mitigation costs for soil removal and a vapor intrusion mitigation system. This cost is considered minimal and given that most properties planned for new development in San Francisco require environmental investigation and likely some remediation work, it is considered consistent with the market.

ASSESSOR'S MAP



The appraiser is not an expert in contamination and the reader is referred to the Limiting Condition in Chapter I of this report which assumes the site and building areas are clean of any toxic contaminants.

No wetlands were observed on the subject property.

C. Flood Zone and Seismic Information

The city of San Francisco is a participant in the National Flood Insurance Program administered by the Federal Emergency Management Agency (FEMA); however, flood insurance is currently not available. FEMA relies on flood insurance rate maps (FIRMs) to determine flood risk. There are currently no finalized and approved FIRMs for San Francisco. In 2007, FEMA published preliminary flood maps for San Francisco. Once the preliminary flood maps are finalized these FIRMs will be used to determine flood insurance rates and federally sponsored flood insurance will be available. Currently, properties in San Francisco do not have a flood zone designation.

According to governmental geological evaluations, the entire San Francisco Bay Area is located in a seismic zone. No active faults, however, are known to exist on the subject property. Inasmuch as similar seismic conditions generally affect competitive properties, no adverse impact on the subject property is considered. The subject is not located in an Alquist Priolo earthquake zone.

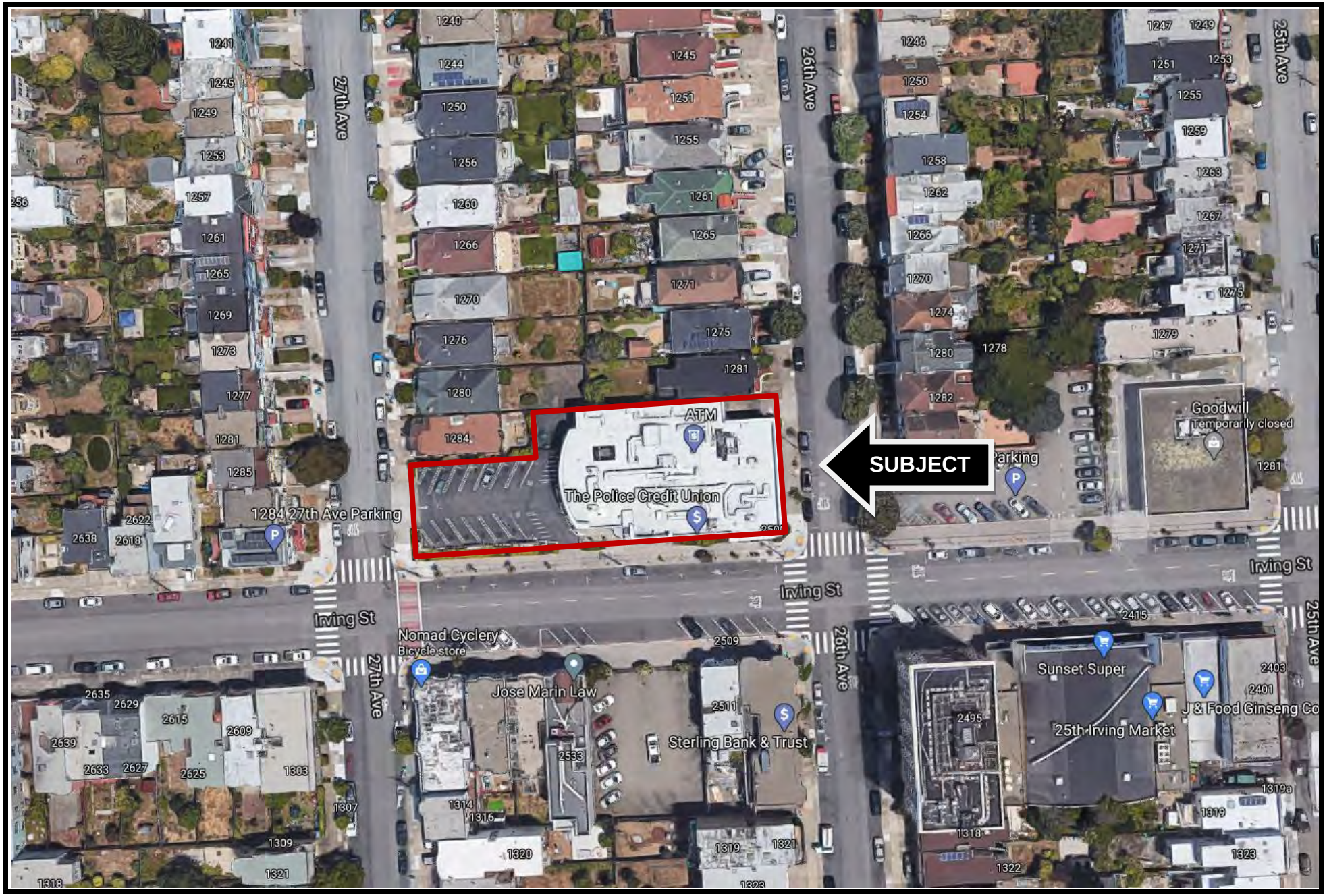
D. Ownership and Sales History

According to the preliminary title report provided for review, issued by Old Republic Title Company and dated October 30, 2020, the subject is owned by SF Police Credit Union, a California corporation. There have been no transfers of the subject property in the last three years according to our research.

The subject property is currently under contract to be purchased by Tenderloin Neighborhood Development Corporation (TNDC) a California non-profit public benefit corporation. The contract was signed on October 12, 2019 and the purchase price is $9,000,000. This is equal to approximately $471 per square foot.

There have been 7 Amendments to the Purchase and Sale Agreement, with the 7th Amendment dated March 1, 2021. The 7th Amendment indicates that the Closing Date may be extended to August 31, 2021, upon the buyer's deposit of $250,000. This amount is nonrefundable to the buyer and will be credited against the purchase price at closing. The buyer has the right to extend the Closing Date for up to two periods of 45 days each by notifying the Seller and Title Company at least 10 days prior to the closing date. The buyer will be required to deposit $50,000 for the 1st 45-day extension period and $100,000 for the 2nd 45-day extension period. These deposits will be credited against the purchase price at closing. According to the

AERIAL MAP


SUBJECT
ATM
The Police Credit Union
1284 27th Ave Parking
Goodwill
Temporarily closed
Nomad Cyclery
Bicycle store
Jose Marin Law
Sterling Bank & Trust
Sunset Super
25th Irving Market
Irving St
26th Ave
27th Ave
25th Ave

purchaser $400,100 has been made in deposits on the property as of the date of the appraisal.

The purchase agreement indicates that there is a Leaseback Agreement which will commence upon the close of escrow and expire 30 months after the closing date. The leaseback agreement includes the entire ground floor of the property approximately 10,750 square feet. The landlord may terminate the lease on 6 months prior notice to tenant, but it shall not be earlier than 24 months of the term. The tenant may terminate the lease at any time providing 6 months' notice. The rent is $5,000 per month "Gross rent" and the seller is responsible for all utilities during this period. The landlord is responsible for property taxes and insurance. The tenant has the right to use the premise for the purpose of a credit union retail branch and office. The leaseback also includes 7 parking spaces.

According to the broker, the subject property was openly marketed for sale prior to entering contract.

E. Zoning and Use

The subject property is zoned NCD, Irving Street Neighborhood Commercial District, which is a portion of the NC-2 District. The district includes the non-residential currently zoned NC-2 properties fronting both sides of Irving Street between 19th and 27th Avenues. This designation is to provide a selection of convenience goods and services for the residents of the Outer Sunset District. The zoning designation allows a variety of commercial and residential uses.

Permitted commercial uses include retail sales and services, restaurants, bars, and medical, personal, or professional services. Commercial uses requiring a conditional use permit include formula retail, large scale urban agriculture, automotive uses (such as a gas station, car wash, parking lot/garage, or auto repair shop) tourist hotels, liquor stores, upper floor general offices and animal hospitals. Institutional uses such as childcare facilities, or other public/community facilities are permitted, but hospitals are not permitted. Industrial uses are not permitted.

The height limit is 40 feet and the maximum FAR for commercial uses is 2.5:1. Residential uses are allowed at a maximum density of one unit for every 800 square feet of lot area, or the density permitted in the nearest R District, whichever is greater. Usable open space is required at 100 square feet per dwelling unit (if private) or 133 square feet per unit if common. No parking is required.

The subject property is currently listed by the San Francisco Planning Department has having a CEQA category rating of "A – Historic Resource Present." The San Francisco Property Information website indicates that while the subject may be eligible due to its proximity to the Parkway Terrace Historic District, the Neighborhood Corridors Historic Resources Survey is still in progress and the subject's status is yet to be finalized. According to the City, the Parkway Terrace

SUBJECT PHOTOGRAPHS



Exterior on Irving Street



Exterior on Irving Street



Exterior on Irving Street



Exterior on 26th Avenue

SUBJECT PHOTOGRAPHS



Exterior on 26th Avenue



Parking Lot



Subject Parking Lot from Irving Street



Subject Parking Lot from Irving Street Street

SUBJECT PHOTOGRAPHS



Subject Neighborhood to the West on Irving Street



Subject Neighborhood to the East on Irving Street

Historic District was created to protect the "group of freestanding single-family buildings built between 1915 and 1926 by master builder Fernando Nelson, each on wide lots with generous side setbacks and designed with a consistent scale and materials and architectural style." The subject has been placed under this category due to its proximity to the historic district. However, according to Ms. Stephanie Cisneros, Senior Planner Preservation – Southwest Quadrant, the subject was constructed in 1966 which falls out of this historic time period. Given these factors, the subject is not considered to be affected by any historical restrictions.

The subject commercial use appears to be a legal, conforming use.

Subject as Potential Market Rate Project

The subject property contains 19,125 square feet of land area. Based on the NCD-Irving Street Commercial District zoning a maximum of 24 units would be allowed with four stories under the base density with 3 or 14% on-site BMRs. Under the State Density Bonus program, a total of 32 residential units would be allowed with 6, or 19% on site BMRs. However, if the ***HOME-SF Program*** is utilized a higher number of units and an additional two stories would be allowed.

Under the HOME-SF Program, the required minimum dwelling unit mix, is no less than 40 percent two-bedroom units. Rear yards are required at residential levels of 25 percent. They must also meet useable open space requirements. Usable open space is required at 100 square feet per unit if all spaces are private or a ratio of 1.33 for common usable open space, as a substitute for private open space.

The advantage of the subject parcel is its good frontage on three sides. Assuming the 25 percent rear yard setback, the gross building area on each floor could be up to approximately 14,344 square feet. The increased height limit would be 60 feet, which is approximately 6 floors. The total allowed gross building area is estimated at approximately 86,063 square feet.

The zoning encourages ground floor commercial uses, which indicates a ground floor with approximately 14,344 square feet of retail space/residential entry/parking. The upper five floors indicate a gross building area of approximately 71,719 square feet. To derive a leasable building area, a deduction of 20 percent is made which takes into consideration hallway circulation and common area. The estimated potential leasable residential building area is 57,375 square feet.

The unit mix requirement, of at least 40 percent of the units are two-bedroom units, limits the possible number of units. Approximately 44 percent of the leasable building area, or 25,500 square feet, would therefore be dedicated to two-bedroom units. Assuming an average size of 850 square feet per two-bedroom unit, approximately (30) two-bedroom units would be required in a market-oriented project. Considering the young, profession demographics of the City in general, the

remaining 60 percent of the units would most likely be one-bedroom units. As shown in the market overview, one-bedroom units command a significant rental premium over studio units and are generally considered to be more economically feasible in this instance. Assuming an average of 675 square feet per one-bedroom unit equates to a total of (45) one-bedroom units. In total, the subject site could support an estimated 75 residential units. This is equal to a density of 171 dwelling units per acre.

Assuming of 75 units would be allowed with six stories under the HOME-SF Program, a total of 30% on-site affordable housing unit would be required, which is equal to 23 affordable units. The unit breakdown would be 52 market rate units and 23 affordable units with 8 affordable units at 55 percent of AMI, 7 unit at 80 percent AMI and 8 unit at 110 percent of AMI with ground floor commercial uses.

This number of units and density is supported by other comparable land sales in the subject market area. The property at 2800 Geary Boulevard was recently entitled under the HOME-SF program and is proposed for 43 residential units with ground floor retail and parking. It will include 13 BMR units. The proposed project has a site area of 11,680 square feet and a density of 160 units per acre. Therefore, in terms of development potential the subject as a market rate development is relatively similar with an estimated at 75 dwelling units with ground floor commercial uses at a density of 171 units per acre. Based on discussions with brokers this is considered to be the maximum allowed under zoning as a market rate project.

Subject Developer Proposed Project

The subject developer is currently proposing to develop the subject property with between 90 to 100 affordable units in a seven-story building. The property is proposed to contain 2,250 square feet of community space on the ground level and on-site parking for 11 vehicles. This is equal to a density of 242 dwelling units per acre. This is a higher density than allowed under zoning; however, there are several Affordable Housing Programs which allow eligible projects to have additional height and are exempted from density limits. In addition, these programs allow for administrative approval in lieu of the Planning Commission hearings. However, this is only available for 100% affordable projects.

Under the State Density Bonus Law (AB 1763), 100% affordable housing developments are allowed an 80% density bonus over the permitted base zoning. In addition, there is no maximum density if a project is located within one-half mile of a major transit stop. The proposed site and development can build up to seven stories (three additional stories or 33 feet of height) under the State Density Bonus Program. The property is also eligible for streamlined approval as it is proposed for 100% affordable housing.

F. Easements and Encumbrances

A preliminary title report issued by Old Republic Title Company and dated October 30, 2020 was provided for review. The title report notes that there is an easement affecting a portion of the subject land granted to Pacific Gas and Electric Company.

The title report indicates that there are Special Restrictions on the use of the property recorded June 1989. The restriction consists of conditions attached to a Conditional Use Application which permitted the expansion of the interior floor area and increased the number of off-street parking for the credit union by three spaces.

It also notes Declarations of Use, recorded by Dome Construction, recorded May 17, 2002. This instrument provides permission to occupy, construct and maintain an existing planter strip along 26th Avenue, Irving Street and 27th Avenue which encroaches into the public right-of-way. The title report notes the last recorded transfer was recorded June 24, 1987.

The preliminary title report shows no adverse easements, restrictions or encumbrances.

G. Assessed Valuation and Real Estate Taxes

The assessed value assigned by the San Francisco County Assessor to the subject properties for the current tax year totals $3,927,541. The components of the assessed value are shown below.

2550 Irving Street					
Land	Improvements	Personal	Gross Value	Special	Total Taxes
$ 2,677,878	$ 1,249,663	$ -	$ 3,927,541	$ 740.16	$ 47,810.24

In California, real property is assessed at full market value as determined by the County assessor. A property assessed value increases by a maximum of two percent annually, as mandated by Proposition 13, until the property transfers or is improved. Upon sale, a property is taxed on the basis of one percent of purchase price plus existing bonded indebtedness. The current tax rate is 1.19846368 percent of the assessed value.

The ad valorem taxes for the current tax year for the subject property are $47,070.08. Special charges total $740.16 and includes LWEA 2018 Tax, SF Bay Parcel Tax, SFUSD Facility District, SFCCD Parcel Tax and SF Teacher Support.

H. Description of Existing Improvements

As requested by the client, the subject is appraised under the assumption that the subject improvements will be demolished and developed with multifamily housing.

However, for informational purposes it is noted that the subject property is improved with an owner-occupied San Francisco Police Credit Union. The two-story wood frame structure contains 18,561 square feet and was built in 1966, according to public records. The property has a ground floor bank area with surrounding private offices. The second floor is accessed by a stairway and elevator and contains offices. There is also on-site parking for approximately 15 vehicles.

The existing structure is of average quality and appears to be in fair to average condition. Although it is generally functional for its current use, it does not contribute to site value.

V. HIGHEST AND BEST USE AND VALUATION METHODOLOGY

A. Highest and Best Use

The highest and best use is that use, from among reasonably probable and legal alternative uses, found to be legally permissible, physically possible, financially feasible, and which results in the highest land value.

The four criteria the highest and best use must meet are physical possibility, legal permissibility, financial feasibility, and maximum productivity. Analysis of the subject's highest and best use is made as if the site were vacant, and as improved with the existing improvements.

1. As-If Vacant

a. Physically Possible

The subject is an irregular shape parcel with frontage on three streets. It is generally level and at street grade. The subject site is functional and presents no physical constraints on highest and best use.

b. Legally Permissible

This property is zoned NCD which allows a wide variety of residential uses with associated commercial space. The height limit is 40 feet, and the residential density is one unit per 800 square feet of lot area. This equates to a maximum of 24 units with 3 on-site BMRs units (19% BMR) for the subject site. This is equal to a density of 55 dwelling units per acre. However, if the HOME-SF Program is utilized a higher number of units and an additional two stories would be allowed, with 30% BMR requirement.

As described in the Zoning section, current city zoning and HOME-SF program would allow for an estimated 75-unit mixed use multifamily development. The unit breakdown under the Program would be 70 percent at market rent and 30 percent BMR units, with BMR rents restricted to 55%, 80% and 110% of AMI levels. The subject as a market rate project would have an estimated maximum density of 171 dwelling units per acre with ground floor commercial space.

Although the subject is proposed for an affordable project with 90-100 units and ground floor community space, it is only allowed due to Senate Bill 35 and the State Bonus Law given that it is a 100 percent rent restricted project. Typically, 100 percent affordable projects show no positive land value and are therefore not considered the highest and best use of the site as vacant.

Therefore, based on the legal parameters, the highest and best use of the subject site as-if vacant is for the development of a market rate 75-unit, multifamily residential project with supporting ground floor commercial space.

c. Financially Feasible

The current strength of the residential market supports speculative construction of multi-family residential use. The subject's location would support ground floor commercial use in the residential development.

d. Maximally Productive

In the current market, the maximally productive use of a site like the subject is to entitle the site for multi-family residential building with ground floor commercial space at the maximum density permitted by zoning.

e. Conclusion

After analyzing the subject property based on the four highest and best use criteria, the highest and best use of the subject site, as-if vacant, is concluded to be for entitlement and development with a 75-unit multifamily residential project with ground floor commercial uses. The most likely buyer of the subject as-if vacant is a developer.

2. As Improved

The subject is improved with two-story commercial building which is used as Police Credit Union with supporting offices. The building was built in 1966 and is in fair to average condition. While functional, the improvements do not contribute value to the underlying land and are not consistent with the highest and best use as vacant.

The highest and best use as improved is concluded to be the construction of a market rate multifamily project with ground-floor retail, consistent with the highest and best use as vacant.

B. Valuation Methodology

The valuation of any parcel of real estate is derived principally through three approaches to the market value. From the indications of these analyses, and the weight accorded to each, an opinion of value is reached. Each approach is more particularly described below.

1. Cost Approach

This approach is the summation of the estimated value of the land, as if vacant, and the reproduction of replacement cost of the improvements. From these are deducted the appraiser's estimate of physical deterioration, functional obsolescence and economic obsolescence, as observed during inspection of the property and its environs. The Cost Approach is based on the premise that, except under most unusual circumstances, the value of a property cannot be greater than the cost of constructing a similar building on a comparable site.

2. Sales Comparison Approach

This approach is based on the principal of substitution, i.e., the value of a property is governed by the prices generally obtained for similar properties. In analyzing the market data, it is essential that the sale prices be reduced to common denominators to relate the degree of comparability to the property under appraisal. The difficulty in this approach is that two properties are never exactly alike.

3. Income Approach

An investment property is typically valued in proportion to its ability to produce income. Hence the Income Approach involves an analysis of the property in terms of its ability to provide a net annual income. This estimated income is then capitalized at a market-oriented rate commensurate with the risks inherent in ownership of the property, relative to the rate of return offered by other investments.

The subject property is valued at its highest and best use via the Sales Comparison Approach. The Income and Cost Approaches lack relevance for redevelopment sites.

VI. FEE SIMPLE LAND VALUATION BY THE SALES COMPARISON APPROACH

In the Sales Comparison Approach, the value of the subject is estimated by comparison with recent sales of similar sites planned for redevelopment as residential and/or mixed/use residential with ground floor retail.

As previously discussed, the subject property is proposed for development with 90 to 100-unit affordable apartment project. The affordable units will be targeted for San Francisco's essential workers and families. The project is proposed to contain 2,250 square feet of community focused space on the ground floor as well as 11 on-site parking spaces. However, as the date of value, the subject property is not entitled and there are no regulatory agreements or restrictions for the affordable housing units are recorded on the subject property.

Therefore, for the analysis of the subject in as-is condition we will use the estimated potential number of units which would be allowed under the HOME-SF Program, given the constraints of the existing zoning. This would allow an estimated 75-unit mixed use multifamily development on the parcel, which would consist of 70 percent market rate units and 30 percent BMR units as required by the city. (The proposed 100 percent affordable project would likely show no residual land value and is therefore not the highest and best use of the land site). This is equal to a density of 171 units per acre.

The table on the following page lists the recent sales of properties intended for redevelopment considered similar to the subject. The comparables are summarized in the table on the following page and individually discussed below.

A. Comparable Land Sales

Comparable 1 is located at 198 Valencia Boulevard in the Mission District neighborhood of San Francisco. The comparable contains a total of 9,000 square feet on a single parcel. The corner site has frontage on the northwest corner of Valencia Street and Duboce Avenue. The site is currently improved with a one-story service commercial building occupied by an Oil Changer. The underlying zoning is NCT-3, Moderate Scale Neighborhood Commercial Transit District. The height limit is 50 feet. The property is entitled for a development with 28 units and ground level commercial uses and 19 parking spaces. This equates to a residential density of 136 dwelling units per acre.

In December 2020, this property sold for $6,150,000 or $683 per square foot of site area and $219,643 per proposed unit. The property will include 4 BMR units.

Comparable 2 is located at 4200 Geary Boulevard in the Richmond neighborhood of San Francisco. The comparable contains a total of 16,750 square feet on three parcels. The corner site has frontage on the northeast corner of Geary Boulevard and 6th Avenue. The site is currently improved with a two-story mortuary that is vacant and is located on one parcel, the other two parcels are vacant. The underlying

COMPARABLE LAND SALES

Appraisal of 2550 Irving Street
San Francisco, California

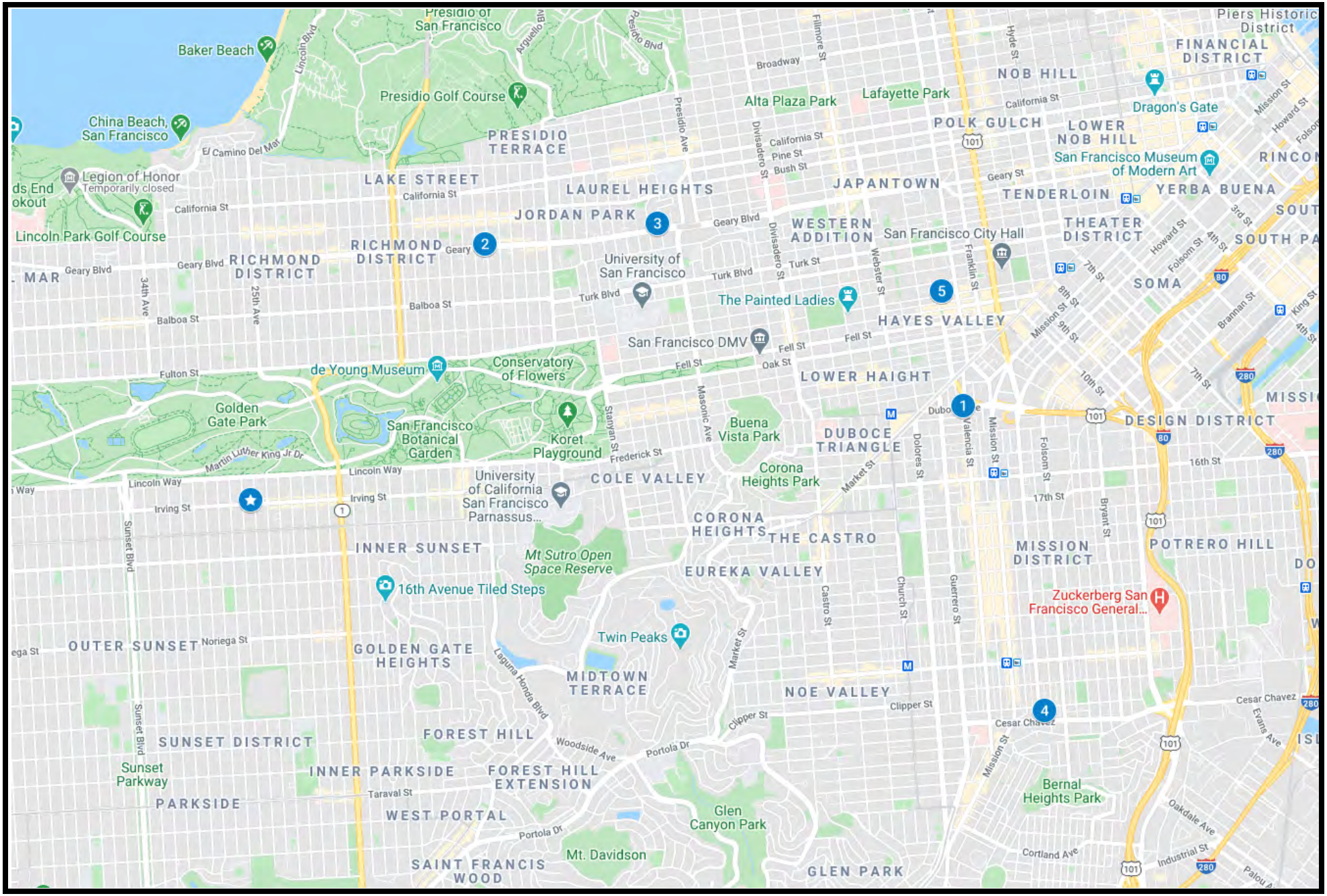
No.	Location/Neighborhood	Sale Date	Land Area	Sale Price	Price Per SF Land Area *Per Unit*	Proposed or Allowed Density Dwellng Units DU/Acre BMR % of Units	Planned Development	Zoning Height Limit Proposed Stories	Grantor/ Grantee/ Document No.
1	**198 Valencia Street** Mission San Francisco Block 3502-108	12/20	9,000 SF 0.21 AC	**$6,150,000** *Entitled*	**$683** *$219,643*	28 DUs 136 Du/Ac *Proposed* 14% BMR	Property was improved with a one story oil automotive use, which is planned to be demolished. Proposed for 5 story building over ground level commercial space and parking.	NCT-3 50' *5 Stories*	Valencia Gamundi LLC/ JS Sullivan Development #06900986
2	**4200 Geary Boulevard** Richmond San Francisco Block 3501 Lots 006 and -007	5/20	16,750 SF 0.38 AC	**$10,500,000** *Unentitled*	**$627** *$107,143*	98 DUs 255 Du/Ac *Proposed* 100% BMR	Property improved with a partial two story 16,822 sf funeral home planned to be demolished. Proposed for 98 senior affordable units with 1,500 sf of retail sf.	NC-3, Geary Blvd 40'-X *7 Stories*	Cathay Mortuary (Wah Sang) Inc./ 4200 Geary Blvd LP #916761
3	**2800 Geary Boulevard** Richmond San Francisco Block 1069 Lot 013	9/19	11,680 SF 0.27 AC	**$4,000,000** *Unentitled*	**$342** *$93,023*	43 Dus (2) 160 Du/Ac *Proposed* 30% BMR	Property improved with 9,320 sf auto repair facility planned to be demolished. Proposed for 43 residential units and retail use. Under HOME-SF Program.	NCD, Geary Blvd 40'-X *6 Stories*	Bridgestone Retail Operations/ South Van Ness 490 LP #834146
4	**1515 South Van Ness Ave** Mission San Francisco Block 6571 Lots 001A, -001 and -008	8/19	34,216 SF 0.79 AC	**$18,500,000** *Entitled*	**$541** *$117,834*	157 DUs 200 Du/Ac *Proposed* 100% BMR	Improved with 31,680 sf warehouse planned to be demolished. Entitled for mixed use development with 157 residential units and 5,241 sf of retail. City plans to build affordable hsg on site.	NCT Mission St 55-65' *6 Stories*	LMC San Francisco I Holdings LLC/ City and County of San Francisco #82000820
5	**618-630 Octavia** Hayes Valley Block 0793 Lots 037 and 038	2/19	9,451 SF 0.22 AC	**$4,600,000** *Unentitled*	**$487** *$153,333*	30 DUs (1) 138 Du/Ac *Proposed* 23% BMR	Proposed for 30 units with 3 BMR units, 4 replacement units (rent controlled) and 1,100 sf of commercial space with State Density Bonus. The is an existing 4 unit apt bldg on site which was owner occupied at time of sale.	NCT-Hayes Gough 40'-X *6 Stories*	Chung HLH Survivor Trust/ Canakkale LLC #732388
	Subject	Contract 10/19	19,125 SF 0.44 AC	**$9,000,000** *Unentitled*	**$471** *$120,000*	75 DUs (2) 171 Du/Ac *(Allowed)* 30% BMR	Property Improved with 2 story credit union that is planned to be demolished. Property proposed for 90-100 affordable residential units with community space on	NCD- Irving St. 40'-X *6 Stories*	

(1) Based on proposed project submitted to the City

(2) Estimated number of units based on State Density Bonus Program or Local/HOME-SF Program

Source: Watts, Cohn & Partners, Inc., May 2021

COMPARABLE LAND SALES MAP



zoning is NC-3, Geary Boulevard Neighborhood Commercial. The property is proposed for a development with 98 affordable senior units and ground level commercial uses. This equates to a residential density of 255 dwelling units per acre.

In May of 2020, this property sold for $10,500,000 or $627 per square foot of site area and $107,143 per proposed unit.

Comparable 3 is located at 2800 Geary Boulevard in the Richmond neighborhood of San Francisco. The comparable contains a total of 11,678 square feet on a single parcel. The site has approximately 89 feet of frontage on Geary and 122 feet of frontage on Wood Street. The comparable is improved with a one story 9,320 square foot automotive building. The underlying zoning is NCD, Geary Boulevard Neighborhood Commercial. The property is proposed to be developed with a mixed-use project with 43 units and ground level commercial use under the HOME-SF bonus height program. The density is equal to 160 units per acre. The project will include 30% BMR units.

In September of 2019, this property sold for $4,000,000, or $342 per square foot of site area and $93,023 per proposed residential unit. The property was originally in contract for $5,000,000, or $428 per square foot. However, once the extent of toxic issues became known and the buyer agreed to fund the clean-up costs on the site, the property closed at a lower sale price of $4,000,000.

Comparable 4 is located at 1515 South Van Ness Avenue in the Mission District of San Francisco. The comparable contains a total of 34,216 square feet on three parcels. The site has approximately 245 feet of frontage on 26th Street and 172 feet of frontage on South Van Ness Avenue. One parcel is improved with a single-story warehouse building and the other two parcels are vacant. The underlying zoning is NCT Mission Street. At the time of sale, the current improvements were proposed for demolition and the property was entitled for a mixed-use development with 157 residential units and 5,241 square feet of retail. This equates to a residential density of 200 dwelling units per acre.

In August of 2019, this property was purchased for $18,500,000 or $541 per square foot of site area and $117,834 per proposed unit. The property was purchased by the City and County of San Francisco for affordable housing.

Land Sale 5 is the sale of 618-630 Octavia Street in the Hayes Valley neighborhood of San Francisco. The property is located midblock between Fulton and Grove Streets. The comparable consists of two parcels of which one was improved with a four-unit apartment building that was built in 1962. The building contains 2,473 square feet. The other adjacent parcel is located at 618 Octavia Street and is a rectangular shaped vacant parcel which had been used for parking. The two parcels contain 9,451 square feet of land area or 0.22 acres. The property is zoned NCT-

Hayes Gough, under the Market and Octavia Area Plan. The property has a height limit of 40 feet. The apartment building was vacant at the time of sale.

The purchaser is currently seeking entitlements for 30 residential units and 1,100 square feet of commercial space, under the State Density Bonus Program with seven BMR units. This is equal to a density of 138 units per acre.

The property was purchased in February 2019 by a developer for $4,600,000. This is equal to $487 per square foot of land area and $153,333 per unit.

B. Analysis

The subject property is valued as-is assuming that it is entitled at the maximum density likely to be approved given the constraints of the existing zoning and the HOME-SF Program. The program would allow for two additional stories, or a total of six stories. It was previously estimated that a total of 75 residential units (including 23 BMR units) could be developed on the subject property. This is equal to a density of 171 units per acre.

By further analyzing the comparable sales, and adjusting for various factors, an appropriate unit value can be concluded for the subject. The comparables indicate a range of unadjusted unit values between $93,023 and $219,643. The range on a land area basis is $342 to $627. For residential development sites, comparison is typically based on a price per planned or approved lot/unit basis. However, for unentitled residential sites that lack approvals, a value on a per square foot of land area basis is considered to be a stronger indicator with secondary weight given to the price per potential unit.

It should be emphasized that although the adjustment process is a mechanical one, the analysis applied by the appraiser is actually less mechanical and more intuitive in nature. Specific adjustments, in all approaches to value, are intended to represent the appraiser's best judgment concerning the differential between each comparable and the subject. Any specific adjustment should be considered general in nature and the overall process is intended to narrow the pattern indicated by the comparable data.

The comparables range in size from 9,000 to 34,216 square feet, and the subject site area is within the range of the comparables in terms of size. A total of 75 units is used in our analysis which is equal to a density of 171 units per acre. The comparables reflect proposed densities of 136 to 255 dwelling units per acre.

Proposed density affects both price per dwelling unit and price per square foot of land, but in opposing ways. Density and price per dwelling unit are inversely related, while density and price per square foot of land area are positively correlated. In other words, all else equal, a higher density site will sell for less on

COMPARABLE LAND SALE ADJUSTMENT GRID

Appraisal of 2550 Irving Street
San Francisco, California

		Sale 1	**Sale 2**	**Sale 3**	**Sale 4**	**Sale 5**
	Subject	198 Valencia Street Mission	4200 Geary Boulevard Richmond	2800 Geary Boulevard Richmond	515 South Van Ness Ave Mission	618-630 Octavia Hayes Valley
Dwelling Units	75	28	98	43	157	30
Density per Acre	171	136	255	160	200	138
Land Area	19,125	9,000	16,750	11,680	34,216	9,451
Sale Date		12/20	5/20	9/19	8/19	2/19
Transaction Price		$6,150,000	$10,500,000	$4,000,000	$18,500,000	$4,600,000
Unadjusted Price Per SF		**$683**	**$627**	**$342**	**$541**	**$487**
Financing Terms		0%	0%	0%	0%	0%
Conditions of Sale		0%	0%	0%	0%	0%
Adjusted Sale Price		$6,150,000	$10,500,000	$4,000,000	$18,500,000	$4,600,000
Adjusted Price/SF		$683	$627	$342	$541	$487
Market Conditions		0.0%	-5%	-5%	-5%	-5.0%
Adjusted Price/Per SF		$683	$596	$325	$514	$462
Location	Irving Street	-10.0%	-5.0%	0.0%	2.5%	-5.0%
Size	19,125	-5.0%	0.0%	0.0%	5.0%	-5.0%
Site Utility	3 Street Frontages	5.0%	5.0%	10.0%	0.0%	10.0%
Site Conditions		0.0%	0.0%	25.0%	0.0%	0.0%
Density	171 DU/AC	0.0%	-5.0%	0.0%	0.0%	0.0%
Height Limit	40'	0.0%	0.0%	0.0%	-2.5%	0.0%
Entitlements	None	-10.0%	0.0%	0.0%	-10.0%	0.0%
BMR %	30.0%	-10.0%	0.0%	0.0%	0.0%	-5.0%
Total Adjusted %		-30.0%	-5.0%	35.0%	-5.0%	-5.0%
Adjusted Price/SF		**$478**	**$566**	**$439**	**$488**	**$439**

19,125 Per SF $470 per sf = $8,988,750

Value (Rounded) $9,000,000

Source: Watts, Cohn & Partners, Inc., May 2021
21-WCP-032

a per dwelling unit basis, and more on a per square foot of land area basis, than a lower density site.

The sales occurred between February 2019 and December 2020. All of the land sales, with exception of Comparable 1, took place or were in contract prior to the Covid-19 virus and pandemic. Although there is no definitive market evidence as of the date of this appraisal of the impact on land value, discussions with brokers suggest downward pressure on land values in the near term which is logical. However, longer term the general sense at least in San Francisco is that the housing shortage will persist, and the City will remain a highly desirable place. This suggests the land market might simply slow as sellers resist lowering prices and wait for market clarity. Nonetheless, in the short term a seller will likely need to reduce price expectations in order to achieve a timely sale. Therefore, a downward adjustment is made to Sales 2, 3, 4, and 5 for market conditions given the current uncertainty in the real estate market.

All of the comparables include existing improvements planned for demolition. Therefore, no adjustment for the cost of demolition is applied, as the contributory value of the improvements on an interim basis, during entitlements, offsets the demolition cost.

There are many variables that determine the quantity of inclusionary units for each site. These variables include timing and concessions. Timing is an important component, as inclusionary requirements have changed over time. A developer can achieve concessions by swapping some requirements for more or less BMR units, such as more or less required open space, or a higher residential tower. These factors are considered when applying the BMR adjustments.

Land Sale 1 is the sale of a property at 198 Valencia Street in the Mission District. The property was purchased with entitlements at $683 per square foot. The location of the neighborhood is considered superior to the subject's location requiring a downward adjustment. The property is also smaller in size. The comparable is a corner site and the three-street frontage of the subject is superior. An upward adjustment for site utility is made. The density and height limit are similar to the subject. However, the comparable received entitlements prior to the sale. A negative adjustment is also made for the superior lower BMR requirement of the comparable. Overall, a lower per square foot value is indicated for the subject.

Land Sale 2 pertains to the sale of a development site at 4200 Geary Boulevard in the Richmond District. The property was purchased for $627 per square foot. The property is similar to the subject in terms of its zoning, height limit and size. It is proposed for 100% affordable senior housing. The comparable is considered to have a superior location and a downward adjustment is indicated. The density is also higher. A partial offsetting adjustment is made for the comparable's corner street frontage which is considered inferior to the subject in terms of site utility. Overall, a lower unit value is indicated on a per square foot basis.

Land Sale 3 is the sale of 2800 Geary Boulevard in the Richmond neighborhood of San Francisco. The comparable was purchased for $342 per square foot. The property is situated at the northwest corner of Geary Boulevard and Wood Street, just west of the tunnel at Masonic Avenue. The property is similar to the subject in terms of density, height limit and zoning. Although the property has a corner location, the access to the site is primarily from Wood Street as Geary Boulevard is only one way along the street frontage as west bound Geary emerges from a tunnel. The comparable is therefore considered difficult to access and an upward adjustment is made for site utility. An upward adjustment is also made for Site Conditions as the property had toxic issues with unknown costs of clean up at the time of sale which the buyer agreed to fund. An upward adjustment is made for clean-up risks under Site Conditions. The comparable is similar to the subject in other respects. After adjustments, a higher unit value is warranted for the subject.

Land Sale 4 is the August 2019 sale of 1515 South Van Ness Avenue in the Mission District. It sold with entitlements for $541 per square foot. This property is similar to the subject in terms of zoning and density. However, it is larger than the subject and has an inferior location. Offsetting factors are the superior height limit of the comparable and that the property is entitled. Overall, a lower unit value is indicated for the subject.

Land Sale 5 is the sale of a development located in Hayes Valley. The comparable has a superior neighborhood location in Hayes Valley and is smaller in size warranting a downward adjustment. However, the comparable has a mid-block location that is inferior in terms of site utility. A negative adjustment is also indicated given that comparable has a lower 23% BMR requirement. Overall, on a land area basis, a lower per square foot value is indicated.

The subject property is currently under contract to be purchased for $9,000,000 which is equal to approximately $471 per square foot. The subject was openly marketed and entered into contract in October 2019.

Conclusions

After adjustments, the comparables indicate a range of values from approximately $439 to $566 per square foot of site area. The subject is a good site that has three street frontages with good utility and visibility. There are limited larger sites available in the western portion of San Francisco.

Based on the analysis of the comparables, the physical and locational attributes of the subject, as well as market conditions, a per square foot value of between $450 and $500 is estimated. A mid-range per square foot value of $470 is concluded. Applying this to the total site area results in a total market value for the subject as a redevelopment site, by the Sales Comparison Approach, as follows:

19,125 SF	x	$470 /SF	=	$8,988,750
Rounded				$9,000,000

The concluded value is equivalent to approximately $120,000 per residential unit based on 75 residential units as allowed under the current zoning and HOME-SF Program. This is below Comparables 1 and 5 but is higher than Comparables 2 and 4 which is considered reasonable given that the properties with higher densities typically sell for lower prices per unit, and vice versa. In addition, Comparable 3 had toxic issues which suggests a higher unit value for the subject. Therefore, the concluded value appears to be supported and reasonable.

VII. VALUE CONCLUSION

Based on the research and analyses contained in this report, and subject to the assumptions and limiting conditions contained herein, it is the opinion of the appraisers that the fee simple market value of the subject property, assuming it is a vacant land development site, as of March 29, 2021, is estimated to be:

NINE MILLION DOLLARS

($9,000,000)

It is the opinion of the appraiser that the above concluded market value for the subject property could be achieved within 12 months of exposure period as of the date of value.

ADDENDA

ORDER NO. : 0227022715

EXHIBIT A

The land referred to is situated in the County of San Francisco, City of San Francisco, State of California, and is described as follows:

(A) Beginning at the point of intersection of the Northerly line of Irving Street with the Westerly line of 26th Avenue; running thence Westerly along the Northerly line of Irving Street 82 feet and 6 inches; thence at a right angle Northerly 90 feet; thence at a right angle Easterly 82 feet and 6 inches to the Westerly line of 26th Avenue; thence Southerly along the Westerly line of 26th Avenue 90 feet to the point of beginning.

Being a portion of Outside Land Block No. 647.

(B) Beginning at a point on the Northerly line of Irving Street, distant thereon 82 feet and 6 inches Westerly from the Westerly line 26th Avenue; running thence Westerly along the Northerly line of Irving Street 25 feet; thence at a right angle Northerly 90 feet;. thence at a right angle Easterly 25 feet; thence at a right angle Southerly 90 feet to the point of beginning.

Being a portion of Outside Land Block No. 647.

(C) Beginning at a point on the Northerly line of Irving Street, distant thereon 107 feet and 6 inches Westerly from the Westerly line of 26th Avenue; running thence Westerly along the Northerly line of Irving Street 25 feet; thence at a right angle Northerly 90 feet; thence at a right angle Easterly 25 feet; thence at a right angle Southerly 90 feet to the point of beginning.

Being a portion of Outside Land Block No. 647.

(D) Beginning at a point on the Northerly line of Irving Street, distant thereon 82 feet and 6 inches Easterly from the point formed by the intersection of the Northerly line of Irving Street with the Easterly line of 27th Avenue; running thence Easterly along said Northerly line of Irving Street 25 feet; thence at a right angle Northerly 90 feet; thence at a right angle Westerly 25 feet; thence at a right angle Southerly 90 feet to the Northerly line of Irving Street and the point of beginning.

Being a portion of Outside Land Block No. 647.

(E) Beginning at the point of intersection of the Easterly line of 27th Avenue and the Northerly line of Irving Street; running thence Northerly along said line of 27th Avenue 60 feet; thence at a right angle Easterly 82 feet and 6 inches; thence at a right angle Southerly 60 feet to the Northerly line of Irving Street; thence at a right angle Westerly along said line of Irving Street 82 feet and 6 inches to the point of beginning.

Being part of Outside Land Block No. 647.

Assessor's Lot 038; Block 1724

OLD REPUBLIC TITLE COMPANY

275 Battery Street, Suite 1500
San Francisco, CA 94111
(415) 397-0500 Fax: (415) 397-0199

PRELIMINARY REPORT

Second Amend

TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION
49 Powell Street, 3rd Fl.
San Francisco, CA 94102

Our Order Number 0227022715-MN

When Replying Please Contact:

Martha Nakagawa
MNakagawa@ortc.com
(415) 397-0500

Buyer:

Tenderloin Neighborhood Development Corporation

Property Address:

2520 Irving Street, San Francisco, CA 94122

In response to the above referenced application for a policy of title insurance, OLD REPUBLIC TITLE COMPANY, as issuing Agent of Old Republic National Title Insurance Company, hereby reports that it is prepared to issue, or cause to be issued, as of the date hereof, a Policy or Policies of Title Insurance describing the land and the estate or interest therein hereinafter set forth, insuring against loss which may be sustained by reason of any defect, lien or encumbrance not shown or referred to as an Exception below or not excluded from coverage pursuant to the printed Schedules, Conditions and Stipulations of said policy forms.

The printed Exceptions and Exclusions from the coverage and Limitations on Covered Risks of said Policy or Policies are set forth in Exhibit I attached. The policy to be issued may contain an arbitration clause. When the Amount of Insurance is less than that set forth in the arbitration clause, all arbitrable matters shall be arbitrated at the option of either the Company or the Insured as the exclusive remedy of the parties. Limitations on Covered Risks applicable to the Homeowner's Policy of Title Insurance which establish a Deductible Amount and a Maximum Dollar Limit of Liability for certain coverages are also set forth in Exhibit I. Copies of the Policy forms should be read. They are available from the office which issued this report.

Please read the exceptions shown or referred to below and the exceptions and exclusions set forth in Exhibit I of this report carefully. The exceptions and exclusions are meant to provide you with notice of matters which are not covered under the terms of the title insurance policy and should be carefully considered.
It is important to note that this preliminary report is not a written representation as to the condition of title and may not list all liens, defects, and encumbrances affecting title to the land.

This report (and any supplements or amendments hereto) is issued solely for the purpose of facilitating the issuance of a policy of title insurance and no liability is assumed hereby. If it is desired that liability be assumed prior to the issuance of a policy of title insurance, a Binder or Commitment should be requested.

Dated as of October 30, 2020, at 7:30 AM

OLD REPUBLIC TITLE COMPANY
For Exceptions Shown or Referred to, See Attached

The form of policy of title insurance contemplated by this report is:

CLTA Standard Coverage Policy -1990; AND ALTA Loan Policy - 2006. A specific request should be made if another form or additional coverage is desired.

The estate or interest in the land hereinafter described or referred or covered by this Report is:

Fee

Title to said estate or interest at the date hereof is vested in:

S F Police Credit Union, a California corporation

The land referred to in this Report is situated in the County of San Francisco, City of San Francisco, State of California, and is described as follows:

(A) Beginning at the point of intersection of the Northerly line of Irving Street with the Westerly line of 26th Avenue; running thence Westerly along the Northerly line of Irving Street 82 feet and 6 inches; thence at a right angle Northerly 90 feet; thence at a right angle Easterly 82 feet and 6 inches to the Westerly line of 26th Avenue; thence Southerly along the Westerly line of 26th Avenue 90 feet to the point of beginning.

Being a portion of Outside Land Block No. 647.

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Street with the Easterly line of 27th Avenue; running thence Easterly along said Northerly line of Irving Street 25 feet; thence at a right angle Northerly 90 feet; thence at a right angle Westerly 25 feet; thence at a right angle Southerly 90 feet to the Northerly line of Irving Street and the point of beginning.

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(E) Beginning at the point of intersection of the Easterly line of 27th Avenue and the Northerly line of Irving Street; running thence Northerly along said line of 27th Avenue 60 feet; thence at a right angle Easterly 82 feet and 6 inches; thence at a right angle Southerly 60 feet to the Northerly line of Irving Street; thence at a right angle Westerly along said line of Irving Street 82 feet and 6 inches to the point of beginning.

Being part of Outside Land Block No. 647.

Assessor's Lot 038; Block 1724

At the date hereof exceptions to coverage in addition to the Exceptions and Exclusions in said policy form would be as follows:

1. Intentionally Deleted

2. Taxes and assessments, general and special, for the fiscal year 2020 - 2021, as follows:

Assessor's Parcel No	:	LOT 038; BLOCK 1724	
Bill No.	:	171497	
1st Installment	:	$23,905.12	NOT Marked Paid
2nd Installment	:	$23,905.12	NOT Marked Paid
Land Value	:	$2,677,878.00	
Imp. Value	:	$1,249,663.00	

3. The lien of supplemental taxes, if any, assessed pursuant to the provisions of Section 75, et seq., of the Revenue and Taxation Code of the State of California.

4. Any special tax which is now a lien and that may be levied within the City of San Francisco Unified School District Community Facilities District No. 90-1, notice(s) for which having been recorded.

   NOTE: Among other things, there are provisions in said notice(s) for a special tax to be levied annually, the amounts of which are to be added to and collected with the property taxes.

   NOTE: The current annual amount levied against this land is $39.04.

   NOTE: Further information on said assessment or special tax can be obtained by contacting:

   Name : San Francisco Unified School District
   Telephone No. : (415) 241-6480

5. The herein described property lying within the proposed boundaries of the City and County of San Francisco Special Tax District No. 2009-1 (San Francisco Sustainable Financing), as follows:

District No.	:	2009-1
For	:	San Francisco Sustainable Financing
Disclosed by	:	Map filed December 7, 2009, in Book 1 of Maps of Assessment and Community Facilities Districts, Page 33.

6. An easement affecting that portion of said land and for the purposes stated herein and incidental purposes as provided in the following

Granted To	:	Pacific Gas and Electric Company, a corporation
For	:	Wires and cables for the distribution of electricity
Recorded	:	April 21, 1924 in Reel 862 of Official Records, Image 240

Upon the terms and conditions contained therein.

7. Conditions contained and/or referred to in an instrument,

Entitled	:	Notice of Special Restrictions under the City Planning Code
By	:	Edward J. Summerville, Agent
Recorded	:	June 16, 1989 in Official Records under Recorder's Serial Number E381845

Note: Reference is made to said instrument for full particulars.

8. Conditions contained and/or referred to in an instrument,

Entitled	:	Declaration of Use
By	:	Dome Construction
Recorded	:	May 17, 2002 in Official Records under Recorder's Serial Number 2002-H168982-00

Note: Reference is made to said instrument for full particulars.

9. Any facts, rights, interests, or claims that are not shown by the Public Records but that could be ascertained by an inspection of the Land or that may be asserted by persons in possession of the Land.

10. Any unrecorded and subsisting leases.

11. Satisfactory evidence furnished to this Company:

    a) as to the due formation and continued existence of S F Police Credit Union, a California corporation as a legal entity under the laws of California; and

    b) documents from its board of directors authorizing this transaction and specifying the officers to execute on behalf of the corporation.

12. The requirement that this Company be provided with a suitable Owner's Declaration (form ORT 174). The Company reserves the right to make additional exceptions and/or requirements upon review of the Owner's Declaration.

---------- Informational Notes ----------

A. The applicable rate(s) for the policy(s) being offered by this report or commitment appears to be section(s) 1.1 and 2.1.

B. The above numbered report (including any supplements or amendments thereto) is hereby modified and/or supplemented to reflect the following additional items relating to the issuance of an American Land Title Association loan form policy:

NONE

NOTE: Our investigation has been completed and there is located on said land a commercial building known as 2520 Irving Street, San Francisco, CA 94122.

The ALTA loan policy, when issued, will contain the CLTA 100 Endorsement and 116 series Endorsement.

Unless shown elsewhere in the body of this report, there appear of record no transfers or agreements to transfer the land described herein within the last three years prior to the date hereof, except as follows:

NONE

C. NOTE: The last recorded transfer or agreement to transfer the land described herein is as follows:

Instrument Entitled	:	Individual Grant Deed
By/From	:	Paul B. Currivan, Jane F. Currivan and Gregory C. Currivan
To	:	S F Police Credit Union, a California corporation
Recorded	:	June 4, 1987 in Official Records under Recorder's Serial Number E001760

D. November 18, 2020 The above Second Amended Preliminary Report, has been modified for the following :

x Taxes
x Plant Date
x to remove Lots 47,48,49 Block 1781 from the report

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PURCHASE AND SALE AGREEMENT
(APN 1724-038)

This Purchase and Sale Agreement (the "Agreement") is made as of the last date indicated by the signatures of Buyer and Seller below (the "Agreement Date"), by and between THE POLICE CREDIT UNION OF CALIFORNIA, a California nonprofit corporation, formerly known as the SF Police Credit Union, California nonprofit corporation ("Seller"), and TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION, a California non-profit public benefit corporation ("Buyer").

RECITALS

A. Seller is the fee owner of that certain real property consisting of one (1) parcel of land (Assessor's Parcel No. 1724-038) located at 2520-2550 Irving Street, in the City and County of San Francisco, State of California consisting of approximately 19,125 square feet of land (the "Land"), together with improvements thereon (the "Improvements"). The Land and Improvements are defined collectively as the "Property."

B. Buyer desires to buy, and Seller desires to sell, the Property on the terms and conditions set forth in this Agreement.

1. **PURCHASE AND SALE** Seller hereby agrees to sell to Buyer and Buyer hereby agrees to purchase from Seller all of Seller's right, title and interest in and to the Property, subject to the terms of this Agreement. In addition to the portion of the Land and the Improvements included within the term "Property," as described above, the "Property" to be transferred hereunder shall also include all of Seller's right title and interest in and to, if any, (i) all rights, privileges and easements appurtenant to the Property, including, without limitation, all minerals, oil, gas and other hydrocarbon substances on and under the Land (if owned by Seller), as well as all development rights and approvals (subject to any limitations in Section 4), air rights, water, water rights and water stock relating to the Property and any other easements, rights of way or appurtenances used in connection with the beneficial use and enjoyment of the Land (collectively, the "Appurtenances"), (ii) all other structures, fences, parking areas or improvements located on or under the Property (the foregoing together with the Appurtenances are included within the term "Improvements"), and (iii) all personal property located on or in or used in connection with the Property (the "Personal Property"), and all service contracts (if approved by Buyer during the Feasibility Review Period), and any governmental permits and approvals, environmental reports, surveys, other reports, studies and all other plans, specifications, books, records and files, any and all licenses, permits, and other governmental approvals, any and all warranties, guaranties, claims, demands and indemnities, and any and all other intangible rights relating to the ownership, use and operation of all or any part of the Property (collectively, the "Intangible Property").

2. **THE PURCHASE PRICE** The purchase price of the Property shall be Nine Million and No/100ths Dollars ($9,000,000.00) (the "Purchase Price"). The Purchase Price shall be payable as follows:

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(a) Within three (3) business days following the Agreement Date, Buyer and Seller shall open an escrow with Old Republic Title Company, 275 Battery Street, Suite 1500, San Francisco, California, 94111, Attn: Martha Nakagawa (the "Title Company"), and shall deposit a fully signed copy of this Agreement into escrow with the Title Company, and shall execute such instructions as the Title Company may require which are not inconsistent with the provisions of this Agreement

(b) Within three (3) business days following the Agreement Date, Buyer shall deposit with the Title Company via check or wire transfer One hundred Dollars ($100) (the "Option Payment") as non-refundable option consideration for the option to purchase the Property until the expiration of the Feasibility Review Period. The Option Payment shall be non-refundable to Buyer and not applicable to the Purchase Price at the Closing (defined in Section 11(a)).

(c) Within three (3) business days following the Agreement Date, Buyer shall deposit with the Title Company via check or wire transfer an earnest money deposit in the amount of One Hundred Thousand and No/100ths Dollars ($100,000.00) (the "Initial Deposit"). The Initial Deposit shall remain fully refundable to Buyer until the expiration of the Feasibility Review Period and thereafter in accordance with this Agreement. Any accrued interest on the Initial Deposit shall be credited to Buyer.

(d) If this Agreement has not been terminated by the end of the Feasibility Review Period, then within three (3) business days following expiration of the Feasibility Review Period, Buyer shall deposit with the Title Company via check or wire transfer an additional earnest money deposit in the amount of One Hundred Fifty Thousand and No/100ths Dollars ($150,000.00) (the "Second Deposit") together with instructions to the Title Company to immediately release the Initial Deposit, the Second Deposit and the Feasibility Extension Consideration (as defined in Subsection 3(a)) (if paid) to Seller. The Initial Deposit and the Second Deposit are collectively referred to herein as the "Deposit". The Deposit and the Feasibility Extension Consideration (if paid) shall be nonrefundable to Buyer, except as otherwise provided in this Agreement, and applicable towards the Purchase Price. Any accrued interest on the Deposit and the Feasibility Extension Consideration shall be credited to Buyer.

3. **FEASIBILITY REVIEW**

(a) The "Feasibility Review Period" shall be the period beginning on the Agreement Date and ending at 5:00 p.m. (Pacific Time) on the date which is one hundred (100) days following the Agreement Date. Buyer shall have the right to extend the Feasibility Review Period for a period of thirty (30) days ("Feasibility Extension Period") by providing written notice to Seller and Title Company not less than ten (10) days prior to the expiration of the Feasibility Review Period. Concurrently with Buyer's delivery of the notice extending Feasibility Review Period, Buyer shall deposit with Title Company the amount of Fifty Thousand and No/100ths Dollars ($50,000.00) ("Feasibility Extension Consideration") together with instructions to the Title Company to release the Feasibility Extension Consideration to Seller if Seller so desires. Upon receipt by Seller, the Feasibility Extension Consideration shall be non-refundable to Buyer (except in the event of a Seller default) but shall be credited against

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the Purchase Price at Closing.

(b) To the extent that these items exist and are in the Seller's possession or control, without the duty of inquiry, within ten (10) days following the Agreement Date Seller shall provide to Buyer true, correct and complete copies of the following due diligence items concerning the Property (the "Due Diligence Documents"):

(i) All building plans and specifications;
(ii) Any plans relating to grading, erosion control, water, sewer, storm drain, street improvement, landscape and parks or other infrastructure or improvements affecting the Land;
(iii) Operating statements for the past three (3) years;
(iv) All physical inspection reports;
(v) The most current real property tax bills;
(vi) Information on any applicable community facilities district assessments;
(vii) All reports and studies regarding the physical condition of the Property, including but not limited to environmental, biological, archaeological, soils and engineering reports and studies;
(viii) Surveys and topographic maps;
(ix) Covenants, conditions and restrictions rights of use or access, whether or not recorded against the Property;
(x) Notifications by any municipality regarding the Land or any portion thereof;
(xi) Copies of agreements, service contracts or other documents affecting the Property, including any assignable warranties;
(xii) Any land use or occupancy restriction affecting the Land;
(xiii) Copies of any financing documents affecting the Property;
(xiv) Copies of any non-confidential documents relating to disputes, litigation, or settlement of any claims from or against adjacent property owners that could affect Buyer's proposed development of the Property; and
(xv) Any other information regarding the physical, legal or financial condition of the Property.
(xvi) Seller has retained AllWest Environmental to conduct ground water testing on north east corner of the Property ("AllWest Testing"). Notwithstanding anything in this Section 3(b) to the contrary, Seller shall provide to Buyer a true, correct and complete copy of the AllWest Testing report on the Property within ten (10) days following the Agreement Date.

(c) From and after the Agreement Date, Seller shall provide Buyer, its agents and representatives access to the Property, and Buyer, its agents and representatives shall be entitled to enter onto the Property during regular business hours to perform inspections, surveys, tests and appraisals of the Property, including invasive testing, and make any other investigations necessary or appropriate (including discussions with governmental agencies) to determine if the Property is suitable, in Buyer's sole and absolute discretion, for Buyer's intended use, subject to each of the following conditions:

(i) Buyer shall provide written notice to Seller at least forty-eight (48) hours prior to any desired access.

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(ii) After making such tests and inspections, Buyer agrees to promptly restore the Property to its condition prior to such tests and inspections.

(iv) Buyer shall indemnify and hold harmless Seller from all loss, cost and expense (including reasonable attorneys' fees) incurred, suffered by, or claimed against the Seller and caused by Buyer's exercising its rights under this Section 3(c), which indemnity obligation shall survive the expiration or termination of this Agreement.

(v) Buyer shall name, and shall cause its representatives, employees, agents and independent contractors to name, Seller as additionally insured party under Buyer's or its representatives, employees, agents and independent contractors' commercial general liability insurance on an "occurrence basis" against claims for "personal injury", including without limitation, bodily injury or death, or "property damage", for not less than $1,000,000 per occurrence.

(vi) Buyer, in performing its inspections, surveys, tests and appraisals, shall not unreasonably interfere with Seller's business operations the Property, and agrees to coordinate its activities on the Property with Seller with at least three (3) business days' notice. Additionally, so as to not inconvenience Seller's members, the parties agree that none of the work undertaken by Buyer under this provision in the interior of the building on the Property shall take place during Seller's retail branch operating hours. Buyer may undertake work under this provision outside the building on the Property during Seller's retail branch operating hours so long as Seller's credit union members and employees have free and unfettered access to the entrance of the retail branch. Seller agrees to give Buyer one (1) full day for testing work in the parking lot of the Property, upon Buyer delivering to Seller five (5) business days' advance notice for work to occur. The parties will work together on a plan to coordinate the testing work in a manner that will allow limited parking areas for the retail branch as testing work occurs.

(d) During the Feasibility Review Period, Buyer shall have the right to approve or disapprove, in Buyer's sole and absolute discretion, the feasibility of Buyer's proposed use of the Property, including, without limitation, (i) a written commitment letter for acquisition of the Property from the San Francisco Mayor's Office of Housing and Community Development or a similar City agency, (ii) the ability to obtain governmental approvals, including historic designation allowing for the demolition of the existing structures, (iii) permits for Buyer's intended development of the Property, and (iv) financing.

(e) On or before the expiration of the Feasibility Review Period, Buyer shall provide Seller with (i) written notice (the "Approval Notice") of its approval of those matters described in Subsections 3(b) (c) and (d) and any other matters related to the condition of the Property (the "Due Diligence Matters"), as determined by Buyer in its sole and absolute discretion. If Buyer does not provide the Approval Notice prior to the expiration of the Feasibility Review Period, then this Agreement shall automatically terminate as of the expiration of the Feasibility Review Period. If prior to the expiration of the Feasibility Review Period, Buyer delivers notice that any Due Diligence Matter is disapproved ("Disapproval Notice"), then Seller will have ten (10) days

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after delivery of Buyer's Disapproval Notice to deliver written notice to Buyer ("Seller's Cure Notice"), with respect to any disapproved Due Diligence Matter, specifying either (i) the manner in which Seller will remove or cure such disapproved item, or (ii) that Seller will not remove or cure such disapproved item. If Seller fails to timely deliver its Seller's Cure Notice, Seller will be deemed to have not agreed to cure all items of the type described in the Disapproval Notice. Following any election or deemed election by Seller not to cure any such disapproved item contained in the Disapproval Notice, Buyer will have ten (10) days after delivery of Seller's Cure Notice to deliver to Seller Buyer's notice of its election to either (i) proceed with the purchase of the Property subject to any disapproved items Seller does not elect to cure, or (ii) terminate this Agreement. Upon a termination of this Agreement under this Subsection 3(e), the Title Company is instructed to return the Initial Deposit to Buyer. If Seller is obligated or elects to cure or remove a disapproved item and fails to do so at least five (5) business days prior to the Closing Date (defined in Section 11(b)), Seller shall be in material default under this Agreement and Buyer shall be entitled to all rights and remedies hereunder.

(f) Within five (5) business days following the Agreement Date Seller shall deliver to Buyer a preliminary title report for the Property ("Title Report"), together with copies of all documents relating to the title exceptions referred to in the Title Report. Notwithstanding anything to the contrary in this Agreement, on or before the Closing, Seller shall be obligated to remove all monetary liens and encumbrances securing the payment of money from title to the Property. Buyer shall have thirty (30) days from delivery of the Title Report to deliver written notice of any objections to the exceptions shown on the Title Report ("Title Objections"). Seller will have ten (10) days after delivery of Buyer's Title Objection notice to deliver written notice to Buyer ("Seller's Title Notice"), (i) with respect to any Title Objections that are monetary liens or encumbrances securing the payment of money and that arise or result from any act or omission of Seller, specifying the manner in which it will remove or cure such objection, and (ii) with respect to any other Title Objections, specifying either (I) the manner in which Seller will remove or cure such Title Objection, or (II) that Seller will not remove or cure such Title Objection. If Seller fails to timely deliver its Seller's Title Notice, Seller will be deemed to not have agreed to cure all Title Objections of the type described in this Subsection 3(f)(ii). Following any election or deemed election by Seller not to cure any such Title Objection, Buyer will have ten (10) days after delivery of Seller's Title Notice to deliver to Seller Buyer's notice of its election to either (i) proceed with the purchase of the Property, or (ii) terminate this Agreement. Upon a termination of this Agreement under this Subsection 3(f), the Title Company is instructed to return the Initial Deposit to Buyer. If Seller is obligated or elects to cure or remove a Title Objection and fails to do so at least five (5) business days prior to the Closing Date, Seller shall be in material default under this Agreement and Buyer shall be entitled to all rights and remedies hereunder.

4. **REPRESENTATIONS AND WARRANTIES OF SELLER.** The effect of the representations and warranties made in this Agreement shall not be diminished or deemed to be waived by any inspections, tests or investigations made by Buyer or its agents. Seller represents and warrants to Buyer that the following matters are true and correct as of the execution of this Agreement and, will be true and correct as of the Closing:

(a) Seller is a California nonprofit corporation, duly formed, in good standing and validly operating under the laws of the State of California.

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(b) Seller has the right, power and authority to sell, convey and transfer the Property to Buyer as provided herein, and to perform Seller's obligations hereunder and no further consents or approvals are required as a condition to any of the foregoing.

(c) This Agreement and all of the documents to be delivered by Seller to Buyer at the Closing will be duly authorized, executed and delivered by Seller, and will be legal and binding obligations of Seller enforceable in accordance with their respective terms (except to the extent that such enforcement may be limited by applicable bankruptcy, insolvency, moratorium and other principles relating to or limiting the rights of contracting parties generally).

(d) To the best of Seller's knowledge, there are no (a) condemnation, zoning or other land-use regulation proceedings, either instituted or planned to be instituted, which would detrimentally affect the value or use of the Property, and (b) assessments affecting the Property other than as set forth in the Title Report.

(e) To the best of Seller's knowledge, there are no pending actions, suits, proceedings, judgments, orders, decrees, defaults, delinquencies or deficiencies or other actions affecting the Property or Seller's interest therein, nor are there any attachments, execution proceedings, assignments for the benefit of creditors, insolvency, bankruptcy, reorganization or other proceedings pending against Seller, nor are any such proceedings contemplated by Seller. Seller has received no notice of any of the foregoing actions or proceedings and, to the best of Seller's knowledge, none of the same have been threatened against Seller, the Property or any interest therein.

(f) Except as disclosed in the Due Diligence Materials, there are no individuals or entities with any lease or other agreement which grants any rights to use and/or occupy any portion of the Property.

(g) Except to the extent disclosed in the Due Diligence Materials, Seller has no actual knowledge of (i) the existence or prior existence on the Property of any hazardous materials or toxic substances (collectively, "Hazardous Materials" as defined below) , (ii) of any violations at the Property of any federal, state, or local law, ordinance, or regulation relating to industrial hygiene or to the environmental conditions on, under, or about the Property, including but not limited to soil and groundwater conditions, (iii) of any environmental, health, or safety hazards on, under, or about the Property, including but not limited to soil and groundwater conditions. Moreover, Seller has not and hereby covenants that it will not through the Closing, use, treat, store or dispose of any Hazardous Materials at the Property in violation of any federal, state, or local law, regulation or ordinance, and to the best of Seller's knowledge there are no Hazardous Materials located on or about the Property.

Definition: Hazardous Materials: The term "Hazardous Material(s)" shall mean (1) any oil or any fraction thereof or petroleum products or "hazardous substance" as defined in Section 101(14) of CERCLA (42 U.S.C. Section 9601(14) or Section 25281(h) or 25316 of the California Health and Safety Code at such time; any "hazardous waste," "infectious waste" or "hazardous material" as defined in Section 25117, 25117.5 or 25501 (j) of the California Health

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and Safety Code at such time; any other waste, substance or material designated or regulated in any way as "toxic" or "hazardous" in the RCRA (42 U.S.C. Section 6901 et seq.), CERCLA Federal Water Pollution Control Act (33 U.S.C. Section 1251 et seq.), Safe Drinking Water Act (42 U.S.C. Section 300 (f) et seq.), Toxic Substances Control Act (15 U.S.C. Section 2601 et seq.), Clean Air Act (42 U.S.C. Section 7401 et seq.), California Health and Safety Code (Section 25100 et seq. Section 39000 et seq.), or California Water Code (Section 13000 et seq.) at such time, or any other federal, state or local statute, law, ordinance, resolution, code, rule, regulation, order or decree regulating, relating to, or imposing criminal or civil liability or standards of conduct concerning, any hazardous, toxic or dangerous waste, substance or material, as now or at any time hereafter in effect; (2) any additional wastes, substances or material which at such time are classified, considered or regulated as hazardous or toxic under any other present or future environmental or other similar laws (whether common law, statute, rule, regulation, or otherwise) relating to the Property or for the protection of human health, the environment or natural resources; and (3) any substance, product, waste or other material of any nature whatsoever which may give rise to liability under any of the above statutes or under any statutory or common law theory based on negligence, trespass, intentional tort, nuisance or strict liability or under any reported decisions of a state or federal court. Hazardous Materials do not include substances of a type and quantity normally used in the operation and maintenance of improved real property, provided such materials are used in accordance with all applicable laws.

(h) To the best of Seller's knowledge, the Due Diligence Materials to be delivered to Buyer are true, correct and complete, and there are no defaults, notices of default or other material circumstances regarding the matters investigated by Buyer pursuant to Section 3 of this Agreement which have not been disclosed to Buyer.

(i) To the best of Seller's knowledge, neither the Property nor its operation violates in any way any applicable laws, ordinances, rules, regulations, judgments, orders, or covenants, conditions and restrictions, whether federal, state, local, foreign, or private. The Improvements are not in violation of any applicable building or zoning codes, building moratorium or environmental protection codes, laws, regulations, or ordinances.

(j) **Seller's Knowledge**. As used in this Agreement, reference to Seller's knowledge, whether "best" or "actual", means the current actual (not imputed or constructive) knowledge of Eddie Young ("Seller's Representative"), without independent inquiry, and such term shall not include the knowledge of any other person or firm, it being understood by Buyer that (i) Seller's Representative was not involved in the operation of the Property before Seller's acquisition of the Property, (ii) Seller's Representative is not charged with knowledge of any of the acts or omissions of predecessors in title to the Property or the management of the Property before Seller's acquisition of the Property, and (iii) Seller's Current Actual Knowledge shall not apply to, or be construed to include, information or material which may be in the possession of Seller generally or incidentally, but of which Seller's Representative is not actually aware.

5. RELOCATION

(a) Buyer's acquisition of the Property may trigger compliance with local, state

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and/or federal relocation laws (the "Relocation Laws"). In order to meet the requirements of the Relocation Laws, from and after the Agreement Date and with at least 24 hours prior notice to Seller, Buyer or its designee may (with the participation of Seller if Seller desires) communicate with tenants to provide any notices required or permitted under applicable Relocation Laws, and/or to make investigations to determine tenants' eligibility for relocation benefits. Seller shall cooperate with Buyer as necessary to permit Buyer to comply with its obligations under the Relocation Laws, at no out-of-pocket cost to Seller.

(b) Buyer intends to purchase the Property when a satisfactory agreement is reached and is prepared to pay the Purchase Price for the Property. Because Federal funds may ultimately be used in the purchase, however, Buyer is required to disclose to Seller the following information:

(i) The Buyer does not have authority to acquire the Property by eminent domain. In the event Buyer and Seller cannot reach an amicable agreement for the purchase of the Property, subject to the terms of this Agreement, Buyer will not pursue this proposed acquisition.

(ii) The Purchase Price represents the current market value of the Property.

(iii) In accordance with the Uniform Relocation Assistance and Real Property Acquisition Policies Act (URA), owner-occupants who move as a result of a voluntary acquisition are not eligible for relocation assistance. Buyer shall have no liability to Seller for funding of relocation activities.

6. **REPRESENTATIONS AND WARRANTIES OF BUYER.** Buyer represents and warrants to Seller that the following matters are true and correct as of the execution of this Agreement and will be true and correct as of the Closing:

(a) Buyer is a California non-profit public benefit corporation, duly formed, in good standing and validly operating under the laws of the State of California.

(b) This Agreement and all of the documents to be delivered by Buyer to Seller at the Closing will be duly authorized, executed and delivered by Buyer, and will be legal and binding obligations of Buyer enforceable in accordance with their respective terms (except to the extent that such enforcement may be limited by applicable bankruptcy, insolvency, moratorium and other principles relating to or limiting the rights of contracting parties generally).

7. **COVENANTS AND CLOSING CONDITIONS**

(a) Seller hereby covenants with Buyer as follows:

(i) Seller agrees that as of the Closing, no part of the Property, or any interest therein, will be liened, encumbered or have been otherwise transferred in any manner, including but not limited to the granting of any leasehold rights of occupancy or rights of use without Buyer's prior written consent, which may be given or withheld by Buyer in its sole and absolute

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discretion. Seller shall not enter into any new leases for the Property without the prior consent of Buyer, which consent may be withheld in Buyer's sole and absolute discretion.

(ii) Seller shall maintain the Property substantially in its condition existing as of the Agreement Date, reasonable wear and tear excepted, and Seller will make no alterations to the Property without Buyer's prior written consent, which may be given or withheld by Buyer in its sole and absolute discretion.

(iii) Seller shall (I) timely make all payments of property taxes and other assessments that become due and payable respecting the Property prior to the Closing, (II) obtain and maintain in effect through the Closing and shall timely pay all premiums for commercially reasonable amounts of comprehensive general liability, casualty (full replacement cost) and other appropriate insurance on the Property, and (III) shall timely make all principal and interest payments required under any mortgages encumbering the Property (which mortgages shall be removed from title prior to the Closing as required pursuant to Section 3(f) of this Agreement).

(iv) Seller shall promptly notify Buyer of any change in any condition with respect to the Property or of any event or circumstance which makes any representation or warranty of Seller to Buyer under this Agreement materially untrue or misleading, or any covenant of Seller under this Agreement incapable of being performed.

(b) The obligations of Buyer hereunder are subject to the fulfillment of each of the following conditions as of the Closing ("Buyer's Closing Conditions"), which Buyer's Closing Conditions are solely for Buyer's benefit and may be waived in writing by Buyer in its sole discretion:

(i) Seller shall be in a position to convey, transfer or assign, as applicable, the Property and the Title Company shall be irrevocably and unconditionally committed to issue the Owner's Policy (defined in Section 8), each in accordance with the terms of and as described in Section 8, on the Closing Date;

(ii) No material adverse change in the title to, condition of, or otherwise respecting the Property or Seller's interest therein shall have occurred and all of Seller's representations and warranties contained in this Agreement shall be true, complete and correct as of the Closing Date;

(iii) All Seller's Closing Documents (defined in Section 8) shall have been timely deposited into escrow with the Title Company by Seller and Seller must have performed and complied with all covenants, agreements, and conditions required by this Agreement to be performed or complied with by it before or on the Closing Date.

(c) Seller obligation to sell the Property is expressly contingent upon the execution and delivery at Closing of a leaseback agreement ("Leaseback Agreement") to be entered into by and between Seller, as tenant, and Buyer, as Landlord, for the entire ground floor of the Property (approximately 10,750 square feet). The Leaseback Agreement shall be substantially in the form attached hereto as Exhibit A and shall contain the following material provisions: (a) the

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Leaseback Agreement shall commence upon the Closing Date and terminate on the date that is a minimum of thirty (30) months after the Closing Date; (b) the rental shall be Five Thousand and No/100ths Dollars ($5,000.00) per month; (c) the maximum rent hold over shall up to six (6) months shall be Thirty Thousand and No/100ths Dollars ($30,000.00) (Five Thousand and No/100ths Dollars ($5,000.00) per month); (d) Seller shall be responsible for the payment of Seller's pro rata share of any and all utilities during the term of the Leaseback Agreement (if not separately metered) and Seller's own janitorial service; (e) Seller shall use the Property solely for the purpose of Credit Union retail branch and office; (f) Buyer shall give Seller at least six (6) months' notice to vacate no earlier than the twenty-fourth (24th) month; and (g) Seller shall have the exclusive use of seven (7) parking spaces as depicted on Schedule 1 of the Leaseback Agreement. By signing this Agreement Seller agrees and acknowledges that the Leaseback Agreement does not constitute a new tenancy and that Seller will not be eligible for federal or state relocation assistance. Notwithstanding the foregoing, Seller may terminate the Leaseback Agreement at any time providing Seller gives at least six (6) months written notice to Buyer.

8. **SELLER'S CLOSING DOCUMENTS** At least one business day prior to the Closing, Seller shall have deposited into escrow with the Title Company the following documents (the "Seller's Closing Documents"): (a) a grant deed showing title vested in Buyer or it's assignee in a form mutually acceptable to the parties (the "Deed"), executed by Seller, in recordable form, conveying good and marketable fee title to the Property to Buyer free and clear of all claims, liens and encumbrances of every kind and description except those approved by Buyer in accordance with Section 3, which will be evidenced at Closing by an ALTA standard policy of title insurance, or other type of policy as requested by Buyer, in the amount of the Purchase Price(the "Owner's Policy"); (b) a duly executed bill of sale conveying the Personal Property to Buyer free and clear of liens, encumbrances and restrictions of every kind and description, (c) a duly executed Leaseback Agreement; (d) an affidavit certifying that Seller is not a "foreign person" within the meaning of Section 1445(f)(3) of the Internal Revenue Code; (e) reasonable proof of Seller's power and authority to enter into and perform under this Agreement (including the authority of Seller's signatories); and (f) any other documents, instruments or agreements reasonably necessary to close the transaction as contemplated by this Agreement.

9. **BUYER'S CLOSING DOCUMENTS** At least one business day prior to the Closing, Buyer shall deliver to Seller or Title Company: (a) the Purchase Price, less the Deposit, Feasibility Extension Consideration (if paid) and any other amounts to be credited to Buyer pursuant to this Agreement, by wire transfer; (b) a duly executed Leaseback Agreement; (c) reasonable proof of the authority of Buyer's signatories; and (d) any other documents, instruments or agreements reasonably necessary to close the transaction as contemplated by this Agreement.

10. **PRORATIONS AND ADJUSTMENTS** The following shall be prorated and adjusted between Seller and Buyer as of the day of the Closing: (a) accrued general real estate and ad valorem taxes and assessments for the current tax year; and (b) such other items that are customarily prorated in transactions of this nature. For purposes of calculating prorations, Buyer shall be deemed to be in title to the Property for the entire day upon which the Closing occurs. All such prorations shall be made on the basis of the actual number of days of the month which shall have elapsed as of the day of the Closing and based upon a thirty (30) day month and a

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three hundred sixty (360) day year. The amount of such prorations shall be adjusted in cash after the Closing as necessary, as and when complete and accurate information becomes available.

11. CLOSING

(a) Closing. Subject to the terms and conditions (including all conditions to Buyer's obligations to perform under this Agreement) set forth in this Agreement and unless otherwise mutually agreed by Buyer and Seller in writing, or unless this Agreement has been terminated in accordance with its terms, the parties shall consummate the purchase of the Property (the "Closing") through closing on the Closing Date.

(b) Closing Date. The "Closing Date" means the Initial Closing Date, subject to any applicable Extension Term. The "Initial Closing Date" means thirty (30) days following the expiration of the Feasibility Review Period, if and as extended. Buyer may extend the Initial Closing Date for up to two (2) periods of thirty (30) days each (each a "Buyer Extension Term") by notifying Seller and the Title Company at least ten (10) days prior to the Initial Closing Date or expiration of the first Buyer Extension Term, as applicable. Concurrently with delivery of the notice of extension by Buyer, Buyer shall deposit Thirty-Five Thousand and No/100ths Dollars ($35,000.00) with the Title Company for each Buyer Extension Term, together with instructions to the Title Company to release such Closing extension deposit to Seller if Seller so desires. Upon receipt by Seller, such Closing extension deposit shall be non-refundable to Buyer (except in the event of a Seller default) and shall not be credited against the Purchase Price at Closing.

(c) Deposit of Documents and Funds. Upon the dates required pursuant to Section 8 and Section 9:

(i) Seller shall deposit into escrow the Seller's Closing Documents.

(ii) Buyer shall deposit into escrow those funds and documents described in Section 9.

(d) Closing Conditions. Title Company shall close escrow on the Property when (i) all of Buyer's Closing Conditions have been satisfied or waived, (ii) all Seller's Closing Documents have been deposited or delivered as required, and (iii) all documents and funds described in Section 9 have been deposited into escrow by Buyer.

(e) Closing. The Title Company shall close escrow by:

(i) Dating all undated closing documents as of the Closing Date;

(ii) Recording the Deed (which grant deed shall provide for delivery thereof to Buyer after recordation);

(iii) Issuing or irrevocably and unconditionally committing to issue the required Owner's Policy to Buyer; and

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(iv) Paying the Purchase Price to Seller, less any credits to Buyer pursuant to this Agreement, and subject to any amounts required to be paid for closing costs as set forth in Section 12.

12. **CLOSING COSTS**

(a) Seller. Seller shall pay (i) all city and county transfer taxes; (ii) all costs associated with removing any claims, liens or encumbrances from the Property as required under this Agreement, and (iii) its own document drafting charges.

(b) Buyer. Buyer shall pay (i) the premium for the Owner's Policy and if Buyer desires an ALTA extended coverage owner's policy of title insurance, the additional premium over the premium for the Owner's Policy; (ii) the Title Company escrow fee; and (iii) its own document drafting charges.

(c) All other closing costs, transfer taxes, recording fees, and any other costs related to this escrow shall be payable by Seller and Buyer according to the customary practices for the transfer of real property in the County of San Francisco.

13. **DAMAGE, CONDEMNATION** If, prior to Closing, any material portion of the Property is damaged or taken by eminent domain (or is the subject of a pending taking which has not been consummated), Seller shall immediately notify Buyer of such a fact, and Buyer shall have the option to terminate this Agreement upon notice given to the Seller no later than thirty (30) days after the date of Seller's notice. If this Agreement is terminated pursuant to this provision, the Title Company (or Seller, as applicable) shall return the Initial Deposit and the Second Deposit, any documents and funds in escrow to the party depositing such documents and funds, and Buyer and Seller shall each pay one-half (½) the cost of any cancellation fees or costs of Title Company. Thereafter neither Buyer nor Seller shall have any further rights or obligations hereunder, each to the other, except as otherwise set forth in this Agreement. If this Agreement is not terminated, Seller shall assign and turn over at the Closing, and Buyer shall be entitled to receive and keep, all insurance proceeds for damage or awards for the taking by eminent domain relating to the Property, and Buyer and Seller shall proceed to the Closing pursuant to the terms hereof, without modification of the terms of this Agreement and without any reduction in the Purchase Price.

14. **BROKERS** Seller represents that it has not engaged any person entitled to any brokerage commission or finder's fee in connection with this transaction except for Capital Realty Group (Brett Barron and Michael Silva) ("Seller's Broker"). Buyer represents that it has not engaged any person entitled to any brokerage commission or finder's fee in connection with this transaction except for TRI Commercial Real Estate Services, Inc. (Gary Cohen) ("Buyer's Broker"). Seller will pay a commission to Buyer's Broker of two and one-half (2.5%) of the Purchase Price at Closing and shall pay a commission to Seller's Broker pursuant to a separate agreement between Seller and Seller's Broker. Other than with respect to Seller's obligations with respect to the Seller's Broker and Buyer's Broker, no party shall have any obligation to pay any real estate, brokerage or other commission or fee in connection with the matters contained in this Agreement or the conveyance of the Property to Buyer. The parties hereby indemnify and

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hold each other free and harmless from and against any and all costs and liabilities including, without limitation attorneys' fees, for causes of action or proceedings which may be instituted by any broker, agent or finder, licensed or otherwise, claiming through, under or by reason of the conduct of the other in connection with this transaction. The foregoing representation and indemnity shall survive the Closing.

15. **DEFAULT**

(a) **BUYER DEFAULT IN THE EVENT THE CLOSING DOES NOT OCCUR DUE TO A MATERIAL DEFAULT BY BUYER OF ITS OBLIGATIONS UNDER THIS AGREEMENT, THE INITIAL DEPOSIT, THE SECOND DEPOSIT AND THE FEASIBILITY EXTENSION CONSIDERATION SHALL BE PAID TO AND RETAINED BY SELLER AS LIQUIDATED DAMAGES. THE PARTIES HERETO EXPRESSLY AGREE AND ACKNOWLEDGE THAT SELLER'S ACTUAL DAMAGES IN THE EVENT OF A MATERIAL DEFAULT BY BUYER WOULD BE EXTREMELY DIFFICULT OR IMPRACTICABLE TO ASCERTAIN AND THAT THE AMOUNT DESCRIBED IN THIS SECTION 15 REPRESENTS THE PARTIES' REASONABLE ESTIMATE OF SUCH DAMAGES. SELLER SHALL HAVE NO RIGHT TO ADDITIONAL DAMAGES OR ANY OTHER REMEDIES UNDER THIS AGREEMENT, AND SELLER WAIVES ALL RIGHT TO AN ACTION FOR SPECIFIC PERFORMANCE OF THIS AGREEMENT.**

SELLER'S INITIALS: DS ey **BUYER'S INITIALS:** DS DF

(b) Seller Default. In the event the purchase and sale of the Property does not occur due to a default by Seller of its obligations under this Agreement (including without limitation a breach of any representation or warranty made by Seller), then Buyer shall be entitled to the return of the Initial Deposit, the Second Deposit and Feasibility Extension Consideration and shall further have, as its sole and exclusive remedies in such event, the right to bring an action for specific performance, and to pursue an action for damages against Seller relative to such default.

16. **"AS-IS" SALE AND ENVIRONMENTAL INDEMNIFICATION AND RELEASE**

(a) "AS-IS" Sale. Except as otherwise specifically provided in this Agreement, Seller makes no representation or warranty regarding any aspect of the condition of the Property, its past use, or its suitability for Buyer's intended use. Without limiting the generality of the foregoing provision, but subject to any representations, warranties and covenants expressly set forth in this Agreement that are agreed to survive the Closing, Buyer hereby acknowledges and agrees that, except as expressly provided herein, it is purchasing the Property in its "AS IS, WHERE IS, WITH ALL FAULTS," condition as of the Closing, and neither Seller nor any employee or agent of Seller has made or will make, either expressly or implicitly (except as set forth in this Agreement), and Buyer has not relied upon (except as set forth in this Agreement), any representations, guaranties, promises, statements, assurances or warranties of any kind concerning the Property.

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(b) Buyer's Environmental Indemnification and Release. In the event that Closing occurs, Buyer agrees to indemnify and hold Seller, its agents, contractors, subcontractors, employees or invitees harmless from any and all claims, damages, fines, judgments, penalties, costs, liabilities, or losses arising from or due to the presence of Hazardous Material(s) on the Property either existing at the time of or which may have been brought to it after the Closing Date, provided that Buyer shall have no obligation under this Section 16 for Hazardous Material(s) which are introduced to or released on the Property by Seller (collectively, the "Released Claims" or Indemnification"). Notwithstanding the forgoing, the parties agree that for a period of four (4) years from the Closing ("Term"), should Buyer be compelled by judicial or administrative agency action (together, "Action") to incur costs to indemnify Seller in connection with the Released Claims, Seller will contribute to Buyer up to a total of Two Hundred Fifty Thousand and 00/100 Dollars ($250,000.00) towards Buyer's actual costs associated with the Indemnification ("Seller Contribution"); thereafter, and for purposes of clarification, after payment of the full amount of Seller's Contribution or the expiration of the Term, whichever occurs first in time, Buyer shall then be solely responsible for any and all costs associated with an Action based on the Released Claims. Buyer shall submit to Seller copies of any Action and commercially reasonable back-up documentation of its costs expended on the Indemnification a condition for payment. Additionally, for any action brought by an employee of Seller who works at the Property post-Closing ("Employee"), Seller agrees to hold Buyer harmless from any claims made by an Employee that are deemed to have been caused by Hazardous Material(s)on the Property ("Employee Claim"). Seller's hold harmless of an Employee Claim shall survive the Closing for a period of ten (10) years.

(c) Except as otherwise specifically provided in this Agreement, and in consideration of the covenants, representations, terms, and provisions of this Agreement, Buyer understands and hereby agrees that this Agreement acts as a full and final release by Buyer and its successors of any and all of the Released Claims, whether known or unknown, arising, accruing, or based on facts, events or circumstances in existence on or before the date hereof, whether known or unknown, that Buyer may have, had or may ever have relating to the Released Claims. In connection with this general release, Buyer hereby waives any and all rights which exist or may exist under California Civil Code Section 1542 and any other comparable provision of state, federal, or common law. Civil Code Section 1542 provides:

> A GENERAL RELEASE DOES NOT EXTEND TO CLAIMS THAT THE CREDITOR OR RELEASING PARTY DOES NOT KNOW OR SUSPECT TO EXIST IN HIS OR HER FAVOR AT THE TIME OF EXECUTING THE RELEASE AND THAT, IF KNOWN BY HIM OR HER, WOULD HAVE MATERIALLY AFFECTED HIS OR HER SETTLEMENT WITH THE DEBTOR OR RELEASED PARTY.

DS ey

_____

Seller's Initials

17. Seller's Cooperation. Seller acknowledges that prior to the Closing Buyer may seek certain governmental permits and approvals for the development of the Property. Seller agrees

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to cooperate with Buyer and take all actions and join in all applications and execute all documents reasonably necessary to allow Buyer to pursue and obtain such permits and approvals, provided that such cooperation shall be at no cost or liability to Seller. Buyer shall have no liability to Seller by reason of undertaking these activities in connection with governmental permits or approvals.

18. **MISCELLANEOUS**

(a) Each individual and entity executing this Agreement hereby represents and warrants that he, she or it has the capacity set forth on the signature pages hereof with full power and authority to bind the party on whose behalf he, she or it is executing this Agreement to the terms hereof.

(b) This Agreement is the entire Agreement between the parties hereto with respect to the subject matter hereof and supersedes all prior agreements between the parties with respect to the matters contained in this Agreement. Any waiver, modification or consent with respect to any provision of this Agreement must be set forth in writing and duly executed by the parties. No waiver by any party of any breach hereunder shall be deemed a waiver of any other or subsequent breach.

(c) Time is of the essence in the performance of and compliance with each of the provisions and conditions of this Agreement. Each party agrees to act diligently and in good faith in performing its obligations under this Agreement.

(d) All notices or other communications required or permitted hereunder shall be in writing, and shall be personally delivered or sent by registered or certified mail, postage prepaid, return receipt requested, or electronic mail, shall be deemed received upon (i) if personally delivered, the date of delivery to the address of the person to receive such notice, (ii) if mailed, three (3) business days after the date of posting by the United States post office, (iii) if delivered by overnight delivery, one (1) business day after mailing , and (iv) upon receipt when sent by electronic mail if sent to the email address set forth below.

Seller: The Police Credit Union of California,
1250 Grundy Lane
San Bruno, CA 94066
Attention: Eddie Young
Telephone: (415) 682-3322
Email: eddie@sfpcu.org

with a copy to (but which shall not constitute notice):
Petredis Law Offices
50 W. San Fernando Street, Suite 1315
San Jose, CA 95113
Telephone: (408) 521-4532
Email: nicholas@petredis.com

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Buyer: Tenderloin Neighborhood Development Corporation
201 Eddy Street
San Francisco, California 94102
Attention: Colleen Ma
Telephone: (415) 776-2151
Email: cma@tndc.org

with a copy to:
Gubb & Barshay LLP
505 14th Street, Suite 450
Oakland, CA 94612
Attn: Scott Barshay
Telephone: (415) 781-6600
Email: kelliott@gubbandbarshay.com

Any party may change its address for notice by written notice given to the other in the manner provided in this Section. Any such communication, notice or demand shall be deemed to have been duly given or served on the date personally served, if by personal service, or on the date shown on the return receipt or other evidence of delivery, if mailed.

(e) The parties agree to execute such instructions to Title Company and such other instruments and to do such further acts as may be reasonably necessary to carry out the provisions of this Agreement.

(f) The making, execution and delivery of this Agreement by the parties hereto has been induced by no representations, statements, warranties or agreements other than those expressly set forth herein.

(g) Wherever possible, each provision of this Agreement shall be interpreted in such a manner as to be valid under applicable law, but if any provision of this Agreement shall be invalid or prohibited thereunder, such invalidity or prohibition shall be construed as if such invalid or prohibited provision had not been inserted herein and shall not affect the remainder of such provision or the remaining provisions of this Agreement.

(h) Section and paragraph headings of this Agreement are solely for convenience of reference and shall not govern the interpretation of any of the provisions of this Agreement.

(i) This Agreement shall be governed by and construed in accordance with the laws of the State of California.

(j) In the event of any dispute between the parties regarding this Agreement, prior to exercising any remedies hereunder the parties shall first attempt in good faith to resolve the dispute through non-binding mediation before a neutral mediator at JAMS, or any other mutually agreeable neutral mediator. The parties shall meet with the mediator as requested by the mediator

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within a thirty (30) day period in an attempt to resolve the dispute. Each party shall pay for one-half of the cost of the mediator and for its own costs. If the dispute cannot be resolved through mediation, then the parties may proceed to exercise the remedies available to them under this Agreement.

(k) If any action is brought by either party against the other party, the prevailing party shall be entitled to recover from the other party reasonable attorneys' fees, costs and expenses incurred in connection with the prosecution or defense of such action. For purposes of this Agreement, the term **"**attorneys' fees**"** or "attorneys' fees and costs" shall mean the fees and expenses of counsel to the parties hereto, which may include printing, copying and other expenses, air freight charges, and fees billed for law clerks, paralegals and other persons not admitted to the bar but performing services under the supervision of an attorney.

(l) Subject to Subsection 17(m), this Agreement shall be binding upon and inure to the benefit of each of the parties hereto and to their respective transferees, successors, and assigns.

(m) Neither this Agreement nor any of the rights or obligations of Seller hereunder shall be transferred or assigned by Seller without the prior written consent of Buyer, which may be given or withheld in Buyer's reasonable discretion. Buyer may assign this Agreement and Buyer's rights and obligations hereunder without the Seller's written consent to (i) a nonprofit public benefit corporation affiliated with Buyer, or (ii) a limited partnership in which Buyer or an affiliated nonprofit public benefit corporation or limited liability company is the general partner or the managing general partner. Buyer shall deliver a copy of the fully executed written assignment and assumption agreement to the Title Company prior to the Closing. No other assignment may be made without the prior written consent of the Seller, which may be given or withheld in Seller's sole and absolute discretion.

(n) All Exhibits attached hereto are incorporated by reference.

(o) Notwithstanding anything to the contrary contained herein, this Agreement shall not be deemed or construed to make the parties hereto partners or joint venturers, or to render either party liable for any of the debts or obligations of the other, it being the intention of the parties to merely create the relationship of Seller and Buyer with respect to the Property to be conveyed as contemplated hereby.

(p) This Agreement may be executed in multiple counterparts, each of which shall be deemed an original and all of which together shall constitute but one and the same instrument. Executed counterparts of this Agreement may be delivered by email and such delivery will have the same effect as delivery of an original executed counterpart of this Agreement.

(q) If requested to do so by Seller, Buyer shall cooperate in a simultaneous or tax deferred exchange by permitting Seller to assign this Agreement to a third party (also "Exchange Facilitator") and by accepting a conveyance of the Property from the Exchange Facilitator. The assignment may take effect only simultaneously with the Closing, and in no event shall Seller be relieved of any liability under this Agreement by reason of the assignment and in no event shall the Exchange Facilitator have any right to enforce this Agreement that Seller would not have if

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there had been no assignment. Buyer shall not be required to bear any escrow, title, or other expenses in excess of those Buyer would bear if there were no exchange, nor shall Buyer be required to expend any sums of money in connection with the exchange. Buyer shall not be required to execute any document creating personal liability or assume or be exposed to any liability in connection with an exchange. In no event shall Buyer be required to take title to any property other than the Property, and in no event shall Buyer be responsible for any tax consequences to Seller or any other party in connection with an exchange. Seller agrees and covenants to defend, indemnify, protect, and save harmless Buyer from any liability, damages, loss, cost and expense (including reasonable attorneys' fees) of whatsoever kind and nature arising out of any exchange.

Signatures on Following Page

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IN WITNESS WHEREOF, the parties hereto have caused this Agreement to be executed by their duly authorized representatives as of the Agreement Date.

SELLER:

THE POLICE CREDIT UNION OF CALIFORNIA, a California nonprofit corporation

By: DocuSigned by: Eddie Young C50E59B0B8694A2...

Name in Print: Eddie Young

Its: President & CEO

Date: 10/12/2019

BUYER:

TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION, a California non-profit public benefit corporation

By: DocuSigned by: Don Falk 8589FBFC4FBF458...

Name in Print: Don Falk

Its: Chief Executive Officer

Date: 10/11/2019

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EXHIBIT "A"

LEASEBACK AGREEMENT

This Leaseback Agreement (**"Lease"**) is entered into on _____, _____, by and between **THE POLICE CREDIT UNION OF CALIFORNIA**, a California nonprofit corporation (**"Tenant"**), **TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION**, a California non-profit public benefit corporation (**"Landlord"**).

Recitals

A. Landlord, as buyer, and Tenant, as seller, entered into that certain Purchase and Sale Agreement dated September __, 2019 (**"Purchase Agreement"**) whereby Landlord purchased from Tenant that certain real property consisting of one (1) parcel of land (Assessor's Parcel No. 1724-038) located at 2520-2550 Irving Street, in the City and County of San Francisco, State of California consisting of approximately 19,125 square feet of land, together with improvements thereon (collectively, the **"Property"**). Pursuant to the Purchase Agreement, Landlord agreed to leaseback the entire ground floor of the Property (approximately 10,750 square feet) (the **"Premises"**) to Tenant. The Premises is described on the attached Schedule 1 and is hereby incorporated by this reference.

B. Tenant desires to lease from Landlord, and Landlord desires to lease to Tenant, the Premises upon the terms and conditions set forth in this Lease.

Agreement

1. Grant of Lease.

1.1 Lease Date. Effective upon the Closing Date (as defined in the Purchase Agreement) (the **"Lease Date"**), Landlord hereby leases to Tenant, and Tenant hereby accepts and leases from Landlord, the Premises, together will all rights privileges, easements and appurtenances relating thereto, to have and to hold for the Term of this Lease (as defined below).

1.2 State of Title; Quiet Enjoyment. Landlord covenants that, upon the Lease Date, it shall have full right and power to enter into this Lease. Tenant accepts the Premises subject to all existing liens, encumbrances, charges, conditions, covenants, easements, restrictions, rights-of-way and other matters of record. Provided that Tenant is not in default of this Lease, Landlord agrees that Landlord will not do anything to prevent Tenant's quiet and peaceful possession of the Premises during the Term.

2. Term. The term of this Lease shall commence on the Lease Date and shall expire on the date that is thirty (30) months after the Closing Date after the Lease Date (**"Term"**). Landlord may terminate this Lease on six (6) months' prior written notice to Tenant (**"Landlord's Termination Notice"**), provided, however, that the Termination Notice shall be given no earlier than the twenty-fourth (24th) month of the Term. Tenant may terminate this Lease at any time by providing six (6) months' prior written notice to Landlord (**"Tenant's Termination Notice"**).

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3. Rent.

3.1 Amount of Rent. Tenant shall pay Landlord a monthly rent in the amount of Five Thousand and No/100ths Dollars ($5,000.00) (the "**Rent**"). Rent shall be paid in equal monthly installments, without notice, deduction or offset, in advance, on or before the first day of each month during the Term; provided, however, if the Lease Date is not the first day of a calendar month, then Tenant shall pay to Landlord, on the Lease Date a pro rata portion of the Rent for such partial calendar month, prorated based on a 30-day month. Rent shall be paid to Landlord at the address shown in Section 13 or to such other person or address as Landlord may from time to time specify by written notice to Tenant. Tenant shall pay on demand from Landlord Tenant's pro rata share of any and all utilities during the Term (if not separately metered) and Seller's own janitorial service. If any utilities are separately metered, Tenant shall pay the cost of such utilities directly to the applicable utility company during the Term.

3.2 Rent Obligations. Except to the extent expressly provided in this Lease, no happening, event, occurrence or situation during the Term of this Lease, nor present or future laws, whether foreseen or unforeseen, and however extraordinary, shall relieve Tenant from its liability to pay to Landlord the Rent required by this Lease.

4. Taxes and Expenses.

4.1 Expenses. Rent required to be paid by Tenant to Landlord under this Lease shall "Gross rent." Landlord shall be responsible for payment of property tax and any payments related to bonds encumbering the Premises.

4.2 Payment of Personal Property Taxes. Tenant shall pay before delinquency any personal property taxes, license fees or income taxes related to Tenant's business.

4.3 Landlord's Taxes. Landlord shall pay any municipal, county, state or federal taxes imposed on the Premises attributable to Landlord's development of the Property or rent received under this Lease. Landlord shall pay any real property taxes and bond assessments related to the Premises.

5. Use.

5.1 Use of Premises. Subject to the provisions of this Section 5, Tenant shall have the right to use the Premises solely for the purpose of Credit Union retail branch and office. On or before the end of the Term, Tenant shall remove all its personal property from the Premises, and all property of Tenant not removed hereunder shall be deemed, at Landlord's option, to be abandoned by Tenant and Landlord may store such property in Tenant's name at Tenant's expense, and/or dispose of the same in any manner permitted by law. Tenant shall repair any and all material damage to the Premises caused by Tenant's removal of its furniture, trade fixtures or property hereunder.

5.2 5.2 Tenant's Right of Approval. Tenant shall have the right to approve the use of any other tenant at the Property. Prior to executing any other lease at the Property, Landlord shall give Tenant written notice of the name of the proposed tenant and the specific use(s) that the proposed tenant proposes ("Proposed Use"). Tenant shall have five (5) business

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days to approve or deny the Proposed Use in Tenant's sole absolute discretion by giving written notice to Landlord.

5.3 Designated Parking Spaces. Tenant shall have the exclusive use of seven (7) parking spaces labeled P01, P09, P10, P11, 12, P13, and P14 as depicted on Schedule 1.

5.4 Alterations and Liens. Tenant shall not make any alteration or improvement to the Premises whatsoever without having first obtained Landlord's written consent, such consent not to be unreasonably withheld, delayed or conditioned. Tenant shall not suffer or permit any mechanic's, materialmen's, attachment, execution or other liens or stop notices to attach to or be filed against the Premises, the building and improvements located thereon, any improvements erected by Tenant on the Premises in the future, Tenant's leasehold interest in this Lease, against Landlord, or against any lender holding funds for any work of improvement upon the Premises. In the event that any such lien, stop notice or similar proceeding is filed or commenced, Tenant shall, within thirty (30) days after notice of the filing thereof, cause the same to be discharged of record by payment, deposits, order of court; provided, however, that Tenant shall have the right to contest, with due diligence the validity or amount of any lien or stop notice if Tenant shall give to Landlord security therefore, reasonably acceptable to the Landlord, an amount equal to one and one-half (1 ½) times the original amount of any such claim.

5.5 Pre-approval of Tenant Improvements. Notwithstanding the provisions of Section 5.4, Landlord approves Tenant's improvements ("TI's") shown on the Proposed Plan – First Floor of the Premises as depicted in Schedule 1. For clarification, Landlord approves Tenant's TI's to build four (4) new doors and to install card reader access hardware to an existing door.

5.6 Non-Responsibility. Nothing in this Lease shall be deemed or construed in any way as constituting the consent or request of Landlord, express or implied, by inference or otherwise, to any contractor, subcontractor, laborer or materialmen, for the performance of any labor or the furnishing of any materials for any improvements, alteration, repair or replacement of the building and improvements on the Premises, nor as giving Tenant any right, power or authority to contract for or permit, on Landlord's behalf or as to Landlord's interest, the rendering of any services or the furnishing of any materials. Subject to Section 5.1, Tenant shall notify Landlord in writing in advance of any work performed on the Premises so as to reasonably allow Landlord time to post a notice of non-responsibility, or similar notice allowed under applicable law.

6. "As-Is" Lease. EXCEPT AS EXPRESSLY SET FORTH IN THIS LEASE, TENANT HEREBY ACKNOWLEDGES AND AGREES THAT IT IS LEASING THE PREMISES IN ITS PRESENT "AS IS/WHERE IS WITH ALL FAULTS" CONDITION AND WITH ALL DEFECTS AND, UNLESS OTHERWISE EXPRESSLY PROVIDED IN THIS LEASE, NEITHER LANDLORD NOR ANY EMPLOYEE OR AGENT OF LANDLORD HAS MADE OR WILL MAKE, EITHER EXPRESSLY OR IMPLIEDLY, AND LANDLORD SPECIFICALLY NEGATES AND DISCLAIMS, ANY REPRESENTATIONS,

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GUARANTIES, PROMISES, STATEMENTS, ASSURANCES OR WARRANTIES OF ANY KIND CONCERNING THE PREMISES.

_____ _____

TENANT'S INITIALS LANDLORD'S INITIALS

7. Maintenance of the Premises. Tenant acknowledges that Landlord has not taken possession of the Premises and Tenant hereby agrees that Tenant shall be solely responsible for all costs associated with any maintenance, replacement or repair with respect to the Premises or any portion thereof. Any such responsibilities are solely for the Tenant's purposes, and Tenant has no responsibility to perform any maintenance, replacement or repair for any purpose of the Landlord. Notwithstanding the foregoing, Tenant shall maintain the Premises in a comparable condition as it was at the signing of the Lease. At the expiration of the Term or earlier termination of this Lease, Tenant shall promptly surrender the Premises to Landlord in neat and clean condition.

8. Insurance. During the term of this Lease, Tenant shall maintain a policy of commercial general liability insurance providing coverage on an occurrence form basis with limits of not less than Two Million Dollars ($2,000,000.00) each occurrence for bodily injury and property damage combined, and Five Million Dollars ($5,000,000.00) annual, general aggregate and Landlord shall maintain a policy of property insurance insuring the Real Property.

9. Waiver of Subrogation. Landlord and Tenant each hereby waive all rights of recovery against the other and against the officers, employees, agents and representatives of the other, on account of loss by or damage to the waiving party of its property or the property of others under its control, to the extent that such loss or damage is insured against under any fire and damage insurance coverage.

10. General Prohibition on Assignment, Assignment of Other Agreements. Except as provided herein, Tenant shall not voluntarily or involuntarily mortgage, assign, pledge, hypothecate, or otherwise encumber all or any part of its interest under the Lease without the express prior written consent of Landlord, which may be withheld in Landlord's sole discretion. Any attempted sale, assignment, pledge, hypothecation, or other transfer or encumbrance of Tenant's interest under the Lease in violation of this Section shall be invalid and of no force or effect. Accordingly, Tenant shall not be relieved of any of its obligations under this Lease and post transfer assignee shall not acquire any right under this Lease.

11. Defaults and Remedies.

11.1 Defaults. The occurrence of any of the following shall constitute a material breach and default of this Lease by Tenant:

11.1.1 A failure by Tenant to pay when due the Rent required by this Lease, where such failure continues for ten (10) days after written notice thereof from Landlord; and/or,

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11.1.2 A failure of Tenant to observe and perform any other provision of this Lease to be observed or performed by Tenant where such failure continues for thirty (30) days after written notice thereof from Landlord; provided, that if the nature of such default is curable but the same cannot with due diligence be cured within thirty (30) days, Tenant shall not be deemed to be in default if Tenant, within such thirty (30)-day period, commences curing the default and thereafter diligently prosecutes the same to completion.

11.2 Remedies. In the event of Tenant's default, Landlord may, terminate Tenant's right to possession of the Premises by any lawful means, in which case this Lease shall terminate and Tenant shall immediately surrender possession of the Premises to Landlord.

12. Holding Over.

12.1 Holding Over. In the event that Landlord has not given the Termination Notice to Tenant, Tenant may remain in possession of the Premises after expiration of the Term for up to six (6) months. Such possession by Tenant shall be deemed to be a month-to-month tenancy terminable on thirty (30) days' notice given at any time by either party. All provisions of this Lease, including, without limitation payment of Rent but excluding those pertaining to the Term shall apply to the month-to-month tenancy.

12.2 Holding Over Without Consent. If Tenant, without Landlord's consent, Tenant remains in possession of the Premises after the expiration of the Termination Notice, all provisions of this Lease shall apply except that the Rent shall be Twenty Five Thousand and 00/100ths Dollars ($25,000) per month, and the tenancy shall be a tenancy at sufferance.

13. Notices. All notices, demands, consents, requests or other communications required to or permitted to be given pursuant to this Agreement shall be in writing, shall be given only in accordance with the provisions of this Section, shall be addressed to the parties in the manner set forth below, and shall be conclusively deemed to have been properly delivered: (a) upon receipt when hand delivered during normal business hours (provided that, notices which are hand delivered shall not be effective unless the sending party obtains the signature of a person at such address that the notice has been received); (b) upon receipt when sent by electronic mail if sent before 5:00 p.m. on a business day to the email address set forth below with recipient confirmation of receipt thereafter; (c) upon the day of delivery if the notice has been deposited in an authorized receptacle of the United States Postal Service as first-class, registered or certified mail, postage prepaid, with a return receipt requested (provided that, the sender has in its possession the return receipt to prove actual delivery); or (d) upon delivery after the notice has been deposited with a nationally recognized overnight courier to be delivered by overnight delivery (provided that, the sending party receives a confirmation of actual delivery from the courier). The addresses of the parties to receive notices are as follows:

TO TENANT: The Police Credit Union of California
1250 Grundy Lane
San Bruno, CA 94066
Attention: Eddie Young
Telephone: (415) 682-3322
Email: eddie@sfpcu.org

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TO LANDLORD: Tenderloin Neighborhood Development Corporation
201 Eddy Street
San Francisco, California 94102
Attention: Colleen Ma
Telephone: (415) 776-2151
Email: cma@tndc.org

Each party shall make an ordinary, good faith effort to ensure that it will accept or receive notices that are given in accordance with this Section, and that any person to be given notice actually receives such notice. Any notice to a party which is required to be given to multiple addresses shall only be deemed to have been delivered when all of the notices to that party have been delivered pursuant to this Section. If any notice is refused, the notice shall be deemed to have been delivered upon such refusal. Any notice delivered after 5:00 p.m. (recipient's time) or on a non-business day shall be deemed delivered on the next business day. A party may change or supplement the addresses given above, or designate additional addressees, for purposes of this Section by delivering to the other party written notice in the manner set forth above. The parties agree that the attorney for any party shall have the authority to deliver binding notices on his/her client's behalf to the other party(ies) hereto.

14. Miscellaneous.

14.1 Waiver. No delay or omission in the exercise of any right or remedy of Landlord on any default by Tenant shall impair such a right or remedy or be construed as a waiver. Landlord's consent to or approval of any act by Tenant requiring Landlord's consent or approval shall not be deemed to waive or render unnecessary Landlord's consent to or approval of any subsequent similar act by Tenant.

14.2 Time of Essence. Time is of the essence of each provision of this Lease.

14.3 Non-Merger. If Landlord shall become the holder of any mortgage or deed of trust or other security instrument creating a lien on the leasehold estate of Tenant, or if Landlord shall acquire the building and improvements on the Premises or leasehold estate, or if Tenant, subtenant or assignee of Tenant, shall acquire the entire fee simple interest in the Premises, or if the holder of any mortgage or deed of trust or other security instrument creating a lien on the leasehold estate acquires fee title to the Premises (while such mortgage or deed of trust is in existence on the leasehold estate), no merger of any estate in the Premises shall occur and all estates shall always be kept separate and distinct.

14.4 Successors. This Lease shall be binding on and inure to the benefit of the parties and their successors, subject to the provisions of Section 10.

14.5 Rent Payable in U.S. Money. Rent must be paid in lawful money of the United States of America.

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14.6 Governing Law. This Lease shall be construed and interpreted in accordance with the laws of the State of California.

14.7 Modification. This Lease cannot be amended or modified except by written agreement executed by the parties hereto.

14.8 Captions. The captions of this Lease shall have no effect on its interpretation.

14.9 Singular and Plural. When required by the context of this Lease, the singular shall include the plural.

14.10 Severability. The unenforceability, invalidity, or illegality of any provision shall not render the other provisions unenforceable, invalid, or illegal.

14.11 Joint Obligations. Any agreements, promises, and/or covenants herein imposed upon Tenant under the provisions of this Lease shall constitute joint covenants and conditions to Tenant's rights under this Lease.

14.12 Counterparts. This Lease may be executed in multiple counterparts and shall be valid and binding with the same force and effect as if all parties had executed the same Lease.

15. Relocation. Tenant agrees and acknowledges that this Lease does not constitute a new tenancy and that Tenant will not be eligible for federal or state relocation assistance under local, state and/or federal relocation laws.

IN WITNESS WHEREOF, the parties have executed this Agreement as of the dates written below.

LESSOR:	**TENANT:**
TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION, a California non-profit public benefit corporation	**THE POLICE CREDIT UNION OF CALIFORNIA**, a California nonprofit corporation
By: _____	By: _____
Name: _____	Name: _____
Its: _____	Its: _____
Date: _____	Date: _____

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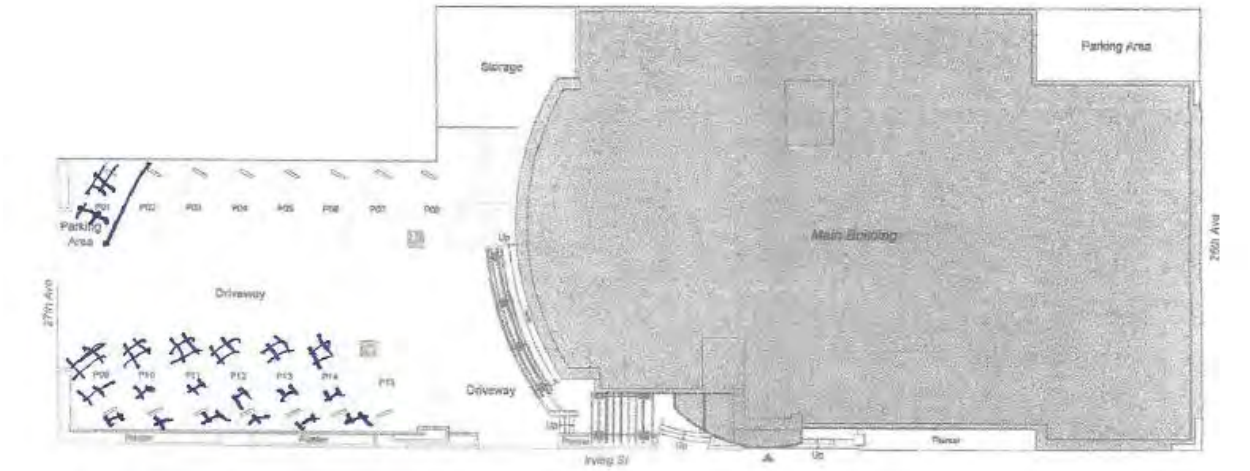
Schedule 1 Page 1 of 2

Property and Premises

2550 IRVING STREET | SAN FRANCISCO, CA 94122



SITE PLAN

Cross-hatched parking for Tenant's exclusive use.

N

Rendering by Floor Plan Visuals • www.fpvisuals.com • 415.670.9269
All measurements are approximate. While deemed reliable, no information on these floor plans should be relied upon without independent verification.

Presented by Brad Barron, Capital Realty Group
Tel: 650.400.7555
Email: bradbarron@capitalrealtygroup.com

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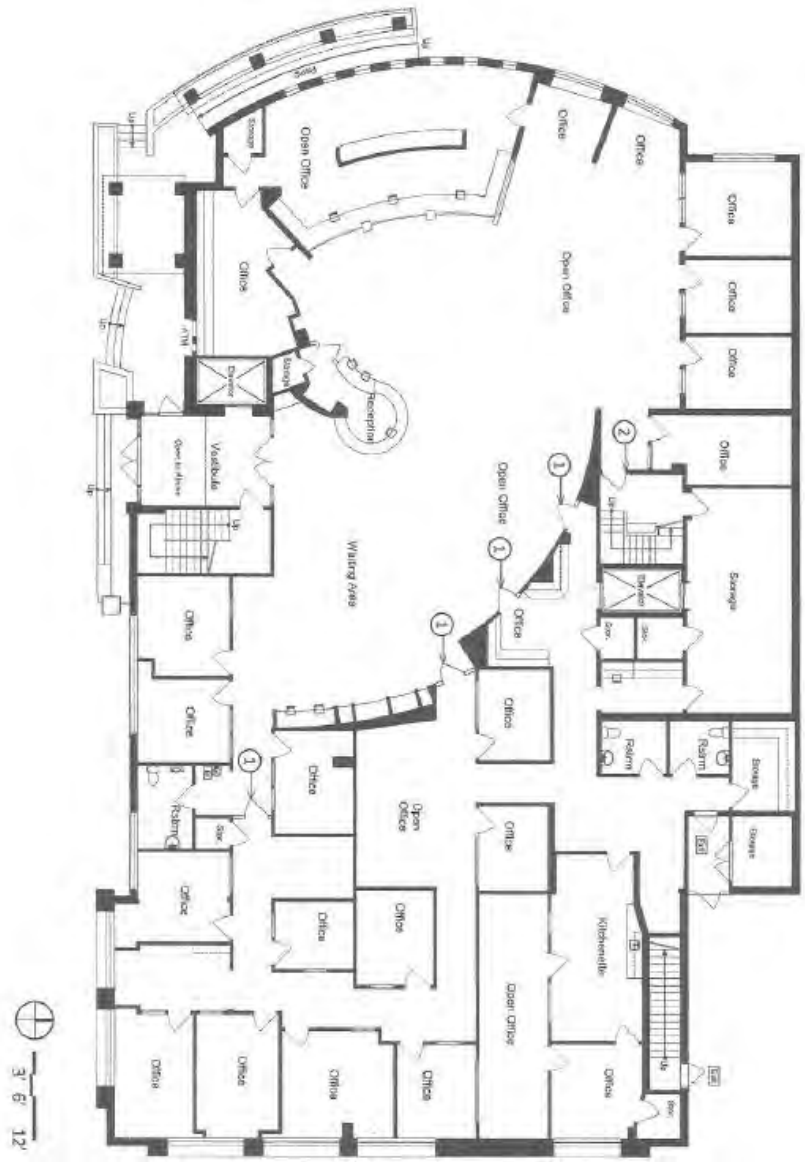
2550 Irving Street | Proposed Plan | First Floor


Open Office
Office
Storage
Vestibule
Reception
Waiting Area
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Kitchenette
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FIRST AMENDMENT TO PURCHASE AND SALE AGREEMENT

THIS FIRST AMENDMENT TO PURCHASE AND SALE AGREEMENT (this "Amendment") is made this 10 day of December, 2019, by and between THE POLICE CREDIT UNION OF CALIFORNIA ("**Seller**"), and TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION ("**Buyer**").

RECITALS

A. Seller and Buyer are parties to that certain Purchase and Sale Agreement having an Agreement Date of October 12, 2019 (the "Agreement").

B. All capitalized terms not otherwise specifically defined in this Amendment shall have meanings ascribed to such terms in the Agreement.

C. Seller and Buyer desire to amend the Agreement in the particular respect set forth below.

NOW, THEREFORE, for valuable consideration, the receipt and adequacy of which is hereby acknowledged, Seller and Buyer do hereby agree as follows:

1. Feasibility Review. The first sentence of Section 3(a) of the Agreement is deleted and replaced with the following sentence: The "Feasibility Review Period" shall be the period beginning on the Agreement Date and ending at 5:00 p.m. (Pacific Time) on February 26, 2020; provided, however, that if Buyer's vapor testing of the Property is not completed by 5:00 p.m. (Pacific Time) on December 15, 2019, the Feasibility Review Period shall be extended day for day that the vapor testing is delayed due to weather for up to thirty (30) days.

2. Closing Date. Section 11(b) of the Agreement is amended and restated in its entirety to read as follows:

> "(b) Closing Date. The "Closing Date" means the Initial Closing Date, subject to any applicable Extension Term. The "Initial Closing Date" means thirty (30) days following the expiration of the Feasibility Review Period, if and as extended. Buyer may extend the Initial Closing Date for one (1) period of thirty (30) days ("Buyer Extension Term") by notifying Seller and the Title Company at least ten (10) days prior to the Initial Closing Date. Concurrently with delivery of the notice of extension by Buyer, Buyer shall deposit Thirty-Five Thousand and No/100ths Dollars ($35,000.00) with the Title Company for the Buyer Extension Term, together with instructions to the Title Company to release such Closing extension deposit to Seller if Seller so desires. Upon receipt by Seller, such Closing extension deposit shall be non-refundable to Buyer (except in the event of a Seller default) and shall not be credited against the Purchase Price at Closing."

3. Counterparts. This Amendment may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute but one and the same instrument. Executed counterparts of this Amendment may be executed electronically and

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delivered by email and such execution and delivery will have the same effect as execution and delivery of an original executed counterpart of this Amendment.

4. Ratification. Except as expressly amended in this Amendment, the Agreement shall remain in full force and effect and is hereby ratified and reaffirmed.

IN WITNESS WHEREOF, the parties have executed this Amendment as of the date first written above.

SELLER:

THE POLICE CREDIT UNION OF CALIFORNIA,
a California nonprofit corporation

By: DocuSigned by: Eddie Young C50E59B0B8694A2...
Eddie Young, President & CEO

Date: 12/20/2019

BUYER:

TENDERLOIN NEIGHBORHOOD
DEVELOPMENT CORPORATION,
a California non-profit public benefit corporation

By: DocuSigned by: Don Falk 038FA1C4FE438...
Don Falk, Chief Executive Officer

Date: 12/10/2019

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SECOND AMENDMENT TO PURCHASE AND SALE AGREEMENT

THIS SECOND AMENDMENT TO PURCHASE AND SALE AGREEMENT ("Second Amendment") is made this 14th day of February, 2020, by and between THE POLICE CREDIT UNION OF CALIFORNIA, formerly known as the SF Police Credit Union, California nonprofit corporation ("**Seller**"), and TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION ("**Buyer**").

RECITALS

A. Seller and Buyer are parties to that certain Purchase and Sale Agreement having an Agreement Date of October 12, 2019, as amended by that certain First Amendment to Purchase and Sale Agreement dated December 10, 2019 ("First Amendment"). The Agreement and First Amendment are hereafter collectively referred to as the "Agreement" unless otherwise noted.

B. All capitalized terms not otherwise specifically defined in this Second Amendment shall have meanings ascribed to such terms in the Agreement.

C. Seller and Buyer desire to amend the Agreement in the particular respect set forth below.

NOW, THEREFORE, in consideration of the covenants contained herein and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, and incorporating these Recitals herein, Seller and Buyer do hereby agree as follows:

AGREEMENT

1. Feasibility Review. The first sentence of Section 3(a) of the Agreement is deleted and replaced with the following sentence: The "Feasibility Review Period" shall be the period beginning on the Agreement Date and ending on the earlier of: **(i)** 5:00 p.m. (Pacific Time) on Thursday, June 25, 2020; or, **(ii)** the date Buyer is in receipt of a final, executed agreement with the Regional Water Quality Control Board, SF Bay Region ("RWQCB") or equivalent governmental agency, under the California Land Reuse and Revitalization Act of 2004 (a "CLRRA Agreement"), or an equivalent agreement between Buyer and the RWQCB, or equivalent governmental agency, which provides substantially the same immunities and protections as a CLRRA Agreement (a "CLRRA Agreement Equivalent"), with respect to the Property.

2. Covenants and Closing Conditions. Amend/add a new subsection (iv) to Section 7(b) as follows:

(iv): Buyer shall be in receipt of a final, executed agreement with the Regional Water Quality Control Board, SF Bay Region ("RWQCB") or equivalent governmental agency, under the California Land Reuse and Revitalization Act of 2004 (a "CLRRA Agreement"), or an equivalent agreement between Buyer and the RWQCB, or equivalent governmental agency, which provides substantially the same immunities and protections as a CLRRA Agreement (a "CLRRA Agreement Equivalent"), with respect to the Property.

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3. Counterparts. This Second Amendment may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute but one and the same instrument. Executed counterparts of this Second Amendment may be executed electronically and delivered by email and such execution and delivery will have the same effect as execution and delivery of an original executed counterpart of this Second Amendment.

4. Ratification. Except as expressly amended in this Second Amendment, the Agreement shall remain in full force and effect and is hereby ratified and reaffirmed.

IN WITNESS WHEREOF, the parties have executed this Second Amendment as of the date first written above.

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SELLER:

THE POLICE CREDIT UNION OF CALIFORNIA,
a California nonprofit corporation

By: DocuSigned by: Eddie Young
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Eddie Young, President & CEO

Date: 2/14/2020

BUYER:

TENDERLOIN NEIGHBORHOOD
DEVELOPMENT CORPORATION,
a California non-profit public benefit corporation

By: DocuSigned by: Donald S. Falk
8589FBFC4FBF458...
Donald S. Falk, Chief Executive Officer

Date: 2/13/2020

THIRD AMENDMENT TO PURCHASE AND SALE AGREEMENT

THIS THIRD AMENDMENT TO PURCHASE AND SALE AGREEMENT ("Third Amendment") is made this 24th day of July, 2020, by and between THE POLICE CREDIT UNION OF CALIFORNIA, formerly known as the SF Police Credit Union, California nonprofit corporation ("**Seller**"), and TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION ("**Buyer**").

RECITALS

A. Seller and Buyer are parties to that certain Purchase and Sale Agreement having an Agreement Date of October 12, 2019, as amended by that certain First Amendment to Purchase and Sale Agreement dated December 10, 2019 ("First Amendment"), and as further amended in that certain Second Amendment to Purchase and Sale Agreement dated February 14, 2020 ("Second Amendment"). The Agreement, First Amendment and Second Amendment are hereafter collectively referred to as the "Agreement" unless otherwise noted.

B. All capitalized terms not otherwise specifically defined in this Third Amendment shall have meanings ascribed to such terms in the Agreement.

C. Seller and Buyer desire to amend the Agreement in the particular respect set forth below.

NOW, THEREFORE, in consideration of the covenants contained herein and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, and incorporating these Recitals herein, Seller and Buyer do hereby agree as follows:

AGREEMENT

1. Buyer's Contribution for Environmental Studies. AllWest Environmental, Inc. ("AllWest") and Haley & Aldrich, Inc. ("H&A") have been retained by Seller to conduct environmental studies on and around the Property. Buyer has agreed to pay Seller Fifty Thousand and 00/100 Dollars ($50,000.00) ("Contribution") towards the cost of the work to be performed by AllWest and H&A. Within three (3) business days from the date of this Third Amendment, Buyer shall wire the Contribution to escrow and the Contribution will be immediately released to Seller. The Contribution shall not be applied against the Purchase Price. Buyer's obligation to pay the Contribution to Seller shall survive termination of the Agreement for any reason including, but limited to, under the provisions of Section 3(e).

2. Feasibility Review Period. Section 3(a) of the Agreement is amended and restated in its entirety to read as follows:

> The "Feasibility Review Period" shall be the period beginning on the Agreement Date and ending at 5:00 p.m. (Pacific Time) on Thursday, August 6, 2020.

3. Business Day. The following is added as new Section 18(r):

"In the event that any date for the performance by either party of any obligation hereunder or the exercise by either party of a right hereunder falls on a Saturday, Sunday, nationally established holiday or established holiday in the State of California, the time for performance of such obligation, or exercise of such right, will be deemed extended until the next business day following such date."

4. Counterparts. This Third Amendment may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute but one and the same instrument. Executed counterparts of this Third Amendment may be executed electronically and delivered by email and such execution and delivery will have the same effect as execution and delivery of an original executed counterpart of this Third Amendment.

5. Ratification. Except as expressly amended in this Third Amendment, the Agreement shall remain in full force and effect and is hereby ratified and reaffirmed.

6. **IN WITNESS WHEREOF**, the parties have executed this Third Amendment as of the date first written above.

SELLER:

THE POLICE CREDIT UNION OF CALIFORNIA,
a California nonprofit corporation

By: _____
Eddie Young, President & CEO

Date: July 24, 2020

BUYER:

TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION,
a California non-profit public benefit corporation

By: _____
Donald S. Falk, Chief Executive Officer

Date: July 27, 2020

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FOURTH AMENDMENT TO PURCHASE AND SALE AGREEMENT

THIS FOURTH AMENDMENT TO PURCHASE AND SALE AGREEMENT ("Fourth Amendment") is made this 5th day of August, 2020, by and between THE POLICE CREDIT UNION OF CALIFORNIA, formerly known as the SF Police Credit Union, California nonprofit corporation ("**Seller**"), and TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION ("**Buyer**").

RECITALS

A. Seller and Buyer are parties to that certain Purchase and Sale Agreement having an Agreement Date of October 12, 2019 ("Agreement"), as amended by that certain First Amendment to Purchase and Sale Agreement dated December 10, 2019 ("First Amendment"), as further amended by that certain Second Amendment to Purchase and Sale Agreement dated February 14, 2020 ("Second Amendment"), and as further amended by that certain Third Amendment to Purchase and Sale Agreement dated July 24, 2020 ("Third Amendment"). The Agreement, First Amendment, Second Amendment and Third Amendment are hereafter collectively referred to as the "Agreement" unless otherwise noted.

B. All capitalized terms not otherwise specifically defined in this Fourth Amendment shall have meanings ascribed to such terms in the Agreement.

C. Seller and Buyer desire to amend the Agreement in the particular respect set forth below.

NOW, THEREFORE, in consideration of the covenants contained herein and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, and incorporating these Recitals herein, Seller and Buyer do hereby agree as follows:

AGREEMENT

1. Feasibility Review Period. Section 3(a) of the Agreement is amended and restated in its entirety to read as follows:

> The "Feasibility Review Period" shall be the period beginning on the Agreement Date and ending at 5:00 p.m. (Pacific Time) on Tuesday, August 11, 2020.

2. Counterparts. This Fourth Amendment may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute but one and the same instrument. Executed counterparts of this Fourth Amendment may be executed electronically and delivered by email and such execution and delivery will have the same effect as execution and delivery of an original executed counterpart of this Fourth Amendment.

3. Ratification. Except as expressly amended in this Fourth Amendment, the Agreement shall remain in full force and effect and is hereby ratified and reaffirmed.

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4. IN WITNESS WHEREOF, the parties have executed this Fourth Amendment as of the date first written above.

SELLER:

THE POLICE CREDIT UNION OF CALIFORNIA,
a California nonprofit corporation

DocuSigned by:
By: Eddie Young
C50E59B0B8694A2...
Eddie Young, President & CEO
Date: August ____, 2020 8/5/2020

BUYER:

TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION,
a California non-profit public benefit corporation

By: Donald S. Falk
Donald S. Falk, Chief Executive Officer
Date: August 5, 2020

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FIFTH AMENDMENT TO PURCHASE AND SALE AGREEMENT

THIS FIFTH AMENDMENT TO PURCHASE AND SALE AGREEMENT ("Fifth Amendment") is made this 5th day of August, 2020, by and between THE POLICE CREDIT UNION OF CALIFORNIA, formerly known as the SF Police Credit Union, California nonprofit corporation ("**Seller**"), and TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION ("**Buyer**").

RECITALS

A. Seller and Buyer are parties to that certain Purchase and Sale Agreement having an Agreement Date of October 12, 2019 ("Agreement"), as amended by that certain First Amendment to Purchase and Sale Agreement dated December 10, 2019 ("First Amendment"), as further amended by that certain Second Amendment to Purchase and Sale Agreement dated February 14, 2020 ("Second Amendment"), as further amended by that certain Third Amendment to Purchase and Sale Agreement dated July 24, 2020 ("Third Amendment"), as further amended by that certain Fourth Amendment to Purchase and Sale Agreement dated August 5, 2020 ("Fourth Amendment"). The Agreement, First Amendment, Second Amendment, Third Amendment and Fourth Amendment are hereafter collectively referred to as the "Agreement" unless otherwise noted.

B. All capitalized terms not otherwise specifically defined in this Fifth Amendment shall have meanings ascribed to such terms in the Agreement.

C. Seller and Buyer desire to amend the Agreement in the particular respect set forth below.

NOW, THEREFORE, in consideration of the covenants contained herein and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, and incorporating these Recitals herein, Seller and Buyer do hereby agree as follows:

AGREEMENT

1. Feasibility Review Period. Section 3(a) of the Agreement is amended and restated in its entirety to read as follows:

> The "Feasibility Review Period" shall be the period beginning on the Agreement Date and ending at 5:00 p.m. (Pacific Time) on Tuesday, August 17, 2020.

2. Counterparts. This Fifth Amendment may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute but one and the same instrument. Executed counterparts of this Fifth Amendment may be executed electronically and delivered by email and such execution and delivery will have the same effect as execution and delivery of an original executed counterpart of this Fifth Amendment.

3. Ratification. Except as expressly amended in this Fifth Amendment, the Agreement shall remain in full force and effect and is hereby ratified and reaffirmed.

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4. I**N WITNESS WHEREOF**, the parties have executed this Fifth Amendment as of the date first written above.

SELLER:

THE POLICE CREDIT UNION OF CALIFORNIA,
a California nonprofit corporation

By: DocuSigned by: Eddie Young C50E59B0B8694A2...
Eddie Young, President & CEO
Date: August 10, 2020

BUYER:

TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION,
a California non-profit public benefit corporation

By: DocuSigned by: Donald S. Falk 8589FBFC4FBF458...
Donald S. Falk, Chief Executive Officer
Date: August 10, 2020

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SIXTH AMENDMENT TO PURCHASE AND SALE AGREEMENT

THIS SIXTH AMENDMENT TO PURCHASE AND SALE AGREEMENT ("Sixth Amendment") is made this 14th day of August, 2020 ("Sixth Amendment Date"), by and between THE POLICE CREDIT UNION OF CALIFORNIA, formerly known as the SF Police Credit Union, California nonprofit corporation ("**Seller**"), and TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION ("**Buyer**").

RECITALS

A. Seller and Buyer are parties to that certain Purchase and Sale Agreement having an Agreement Date of October 12, 2019, as amended by that certain First Amendment to Purchase and Sale Agreement dated December 10, 2019 ("First Amendment"), as amended in that certain Second Amendment to Purchase and Sale Agreement dated February 14, 2020 ("Second Amendment"), as amended in that certain Third Amendment to Purchase and Sale Agreement dated July 24, 2020 ("Third Amendment"), as amended in that certain Fourth Amendment to Purchase and Sale Agreement dated August 5, 2020 ("Fourth Amendment"), and as further amended in that certain Fifth Amendment to Purchase and Sale Agreement dated August 5th, 2020 ("Fifth Amendment") The Agreement, First Amendment, Second Amendment, Third Amendment, Fourth Amendment and Fifth Amendment are hereafter collectively referred to as the "Agreement" unless otherwise noted.

B. All capitalized terms not otherwise specifically defined in this Sixth Amendment shall have meanings ascribed to such terms in the Agreement.

C. Seller and Buyer desire to amend the Agreement in the particular respect set forth below.

NOW, THEREFORE, in consideration of the covenants contained herein and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, and incorporating these Recitals herein, Seller and Buyer do hereby agree as follows:

AGREEMENT

1. Deposit. All references in the Agreement to the "Second Deposit" are deleted. All references in the Agreement to the "Initial Deposit" are deleted and replaced with "Deposit". Section 2(d) of the Agreement is deleted and Section 2(c) of the Agreement is amended and restated in its entirety to read as follows:

> "Within three (3) business days following the Agreement Date, Buyer shall deposit with the Title Company via check or wire transfer an earnest money deposit in the amount of One Hundred Thousand and 00/100 Dollars ($100,000.00) (the "Deposit"). The Deposit shall remain fully refundable to Buyer until the expiration of the Feasibility Review Period and thereafter in accordance with this Agreement. If this Agreement has not been terminated by the end of the Feasibility Review Period, then the Title Company shall release the Deposit to Seller and the Deposit shall be nonrefundable to Buyer, except as

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otherwise provided in this Agreement, and applicable towards the Purchase Price. Any accrued interest on the Deposit shall be credited to Buyer."

2. Feasibility Review. Buyer approves the Due Diligence Matters and this Section 2 of this Sixth Amendment constitutes Buyer's Approval Notice pursuant to Section 3(e) of the Agreement.

3. Closing. Section 11(b) is amended and restated in its entirety to read as follows:

"The "Closing Date" means the Initial Closing Date, subject to any applicable CLRRA Extension Term (defined below). The "Initial Closing Date" means the earlier of thirty (30) days following Buyer's receipt of the CLRRA Agreement or CLRRA Agreement Equivalent (both as defined in the Second Amendment) and May 9, 2021. In the event that the CLRRA Agreement or CLRRA Agreement Equivalent has not been received by May 9, 2021, Buyer shall have the right to extend Closing Date for up to three (3) periods of thirty (30) days each (each a "CLRRA Extension Term") by notifying Seller and the Title Company at least ten (10) days prior to the expiration of the then-current CLRRA Extension Term. Concurrently with delivery of the notice of the CLRRA Extension Term by Buyer, Buyer shall deposit Thirty-Five Thousand and 00/100 Dollars ($35,000.00) with the Title Company for each CLRRA Extension Term, together with instructions to the Title Company to immediately release such CLRRA Extension Term deposit to Seller. Upon receipt by Seller, such CLRRA Extension Term deposit shall be non-refundable to Buyer (except in the event of a Seller default) but shall be credited against the Purchase Price at Closing."

4. Environmental. The heading of Section 16 is amended and restated in its entirety to read as follows: ""**"AS-IS" SALE AND AGREEMENTS REGARDING ENVIRONMENTAL MATTERS**".

5. Environmental Matters. Section 16(b) is amended and restated in its entirety to read as follows:

"16(b). Environmental Matters. Seller shall have no obligation under this Section 16(b) for Hazardous Material(s) which are introduced to or released on the Property by Buyer after the Closing Date (the "Released Claims"). Notwithstanding the foregoing, the parties agree that for a period of ten (10) years from the Closing ("Term"), should Seller be compelled as a result of a governmental judicial or administrative agency action (together, "Governmental Action") against Buyer to incur costs, Seller will contribute to Buyer up to a total of Two Hundred Fifty Thousand and 00/100 Dollars ($250,000.00) towards Buyer's actual costs associated with the Governmental Action ("Seller's Contribution"); thereafter, and for purposes of clarification, after payment of the full amount of Seller's Contribution or the expiration of the Term, whichever occurs first in time, Buyer shall then be solely responsible for any and all costs associated with Governmental Action, as limited and governed by Buyer's negotiated obligations pursuant to Buyer's agreement with DTSC (or equivalent governmental agency) under the CLRRA Agreement or CLRRA Agreement Equivalent. Buyer shall submit to Seller

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copies of any Governmental Action and commercially reasonable back-up documentation of its costs expended on the Governmental Action as a condition of payment.

On-Site Liability: For any action brought post-Closing by an employee of Seller who works or has worked at the Property ("Employee Action") for claims arising from vapor intrusion arising from the Hazardous Material(s) on or emanating from the Property existing at the time of the Closing Date, Seller agrees to indemnify, defend and hold Buyer harmless from any Employee Action that is alleged or deemed to have been caused by vapor intrusion from the Hazardous Material(s) on or emanating from the Property. The parties agree that Seller's defense, indemnity and hold harmless of an Employee Action shall survive the Closing for a period of ten (10) years.

Off-Site Liability: For any action brought post-Closing by third parties for property damage/personal injury/contribution claims arising from vapor intrusion arising from Hazardous Material(s) on or emanating from the Property existing at the time of the Closing Date that have migrated off the Property ("Third Party Action"), Seller agrees to indemnify, defend and hold Buyer harmless from any Third Party Action, with the exception that "Third Party Action" shall not include an action brought by a tenant of Buyer's to-be-constructed residential units. The parties agree that Seller's defense, indemnity and hold harmless of an Employee Action or Third Party Action shall survive the Closing for a period of ten (10) years."

6. Release. Section 16(c) is amended and restated in its entirety to read as follows:

16(c). Except as otherwise specifically provided in this Agreement and subject to Section 16(b) above, and in consideration of the covenants, representations, terms, and provisions of this Agreement, Buyer understands and hereby agrees that this Agreement acts as a full and final release by Buyer and its successors of the Released Claims, whether known or unknown, arising, accruing, or based on facts, events or circumstances in existence on or before the date hereof, whether known or unknown, that Buyer may have, had or may ever have relating to the Released Claims. In connection with this general release, Buyer hereby waives any and all rights which exist or may exist under California Civil Code Section 1542. Civil Code Section 1542 provides:

> A GENERAL RELEASE DOES NOT EXTEND TO CLAIMS THAT THE CREDITOR OR RELEASING PARTY DOES NOT KNOW OR SUSPECT TO EXIST IN HIS OR HER FAVOR AT THE TIME OF EXECUTING THE RELEASE AND THAT, IF KNOWN BY HIM OR HER, WOULD HAVE MATERIALLY AFFECTED HIS OR HER SETTLEMENT WITH THE DEBTOR OR RELEASED PARTY.

Buyer's Initials [DS DF]

7. Counterparts. This Sixth Amendment may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute but one and the same instrument. Executed counterparts of this Sixth Amendment may be executed electronically and delivered by email and such execution and delivery will have the

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same effect as execution and delivery of an original executed counterpart of this Sixth Amendment.

8. Ratification. Except as expressly amended in this Sixth Amendment, the Agreement shall remain in full force and effect and is hereby ratified and reaffirmed.

IN WITNESS WHEREOF, the parties have executed this Sixth Amendment as of the date first written above.

SELLER:

THE POLICE CREDIT UNION OF CALIFORNIA,
a California nonprofit corporation

By: Eddie Young
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Eddie Young, President & CEO

Date: 8/14/2020

BUYER:

TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION,
a California non-profit public benefit corporation

By: DocuSigned by:
Donald S. Falk
8589FBFC4FBF458...
Donald S. Falk, Chief Executive Officer

Date: 8/14/2020

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SEVENTH AMENDMENT TO PURCHASE AND SALE AGREEMENT

THIS SEVENTH AMENDMENT TO PURCHASE AND SALE AGREEMENT ("Seventh Amendment") is made this 1st day of March, 2021 ("Seventh Amendment Date"), by and between THE POLICE CREDIT UNION OF CALIFORNIA, formerly known as the SF Police Credit Union, California nonprofit corporation ("**Seller**"), and TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION ("**Buyer**").

RECITALS

A. Seller and Buyer are parties to that certain Purchase and Sale Agreement having an Agreement Date of October 12, 2019, as amended by that certain First Amendment to Purchase and Sale Agreement dated December 10, 2019 **("First Amendment")**, as amended in that certain Second Amendment to Purchase and Sale Agreement dated February 14, 2020 **("Second Amendment")**, as amended in that certain Third Amendment to Purchase and Sale Agreement dated July 24, 2020 **("Third Amendment")**, as amended in that certain Fourth Amendment to Purchase and Sale Agreement dated August 5, 2020 **("Fourth Amendment")**, as amended in that certain Fifth Amendment to Purchase and Sale Agreement dated August 5, 2020 **("Fifth Amendment")**, and as further amended in that certain Sixth Amendment to Purchase and Sale Agreement dated August 14, 2020 **("Sixth Amendment")**. The Agreement, First Amendment, Second Amendment, Third Amendment, Fourth Amendment, Fifth Amendment and Sixth Amendment are hereafter collectively referred to as the "Agreement" unless otherwise noted.

B. All capitalized terms not otherwise specifically defined in this Seventh Amendment shall have meanings ascribed to such terms in the Agreement.

C. Seller and Buyer desire to amend the Agreement in the particular respect set forth below.

NOW, THEREFORE, in consideration of the covenants contained herein and other good and valuable consideration, the receipt and adequacy of which is hereby acknowledged, and incorporating these Recitals herein, Seller and Buyer do hereby agree as follows:

AGREEMENT

1. Closing. Section 11(b) is amended and restated in its entirety to read as follows:

"The "Closing Date" may be extended from Wednesday, March 3, 2021, to **Tuesday, August 31, 2021**, upon Buyer's deposit of Two Hundred Fifty Thousand and 00/100 Dollars ($250,000.00) into escrow with the Title Company no later than the close of business on March 3, 2021 ("Closing Date Extension Deposit"), together with instructions to the Title Company to immediately release such Closing Date Extension Deposit to Seller. Upon receipt by Seller, the Closing Date Extension Deposit shall be non-refundable to Buyer (except in the event of a Seller default) but shall be credited against the Purchase Price at Closing." Buyer shall have the right to extend the Closing Date for up to two (2) periods of forty-five (45) days each by notifying Seller and Title Company at least ten (10) days prior to the Closing Date then in effect. Concurrently

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with Buyer's extension notice(s), Buyer shall deposit Fifty Thousand and 00/100 Dollars ($50,000.00) for the 1st 45- day extension period ("1st Closing Date Extension") and One Hundred Thousand and 00/100 Dollars ($100,000.00) for the 2nd 45-day extension ("2nd Closing Date Extension"), together with instructions to the Title Company to immediately release each deposit to Seller. Upon receipt by Seller, the 1st Closing Date Extension Deposit, and the 2nd Closing Date Extension Deposit shall be non-refundable to Buyer (except in the event of a Seller default) but shall be credited against the Purchase Price at Closing. For the avoidance of doubt, the Closing Date after Buyer's exercise of the 1st Closing Date Extension shall be **Friday, October 15, 2021,** and should Buyer then exercise of the 2nd Closing Date Extension, the Closing Date shall be **Monday, November 29, 2021**."

2. Counterparts. This Seventh Amendment may be executed in one or more counterparts, each of which shall be deemed an original, but all of which together shall constitute but one and the same instrument. Executed counterparts of this Seventh Amendment may be executed electronically and delivered by email and such execution and delivery will have the same effect as execution and delivery of an original executed counterpart of this Seventh Amendment.

3. Ratification. Except as expressly amended in this Seventh Amendment, the Agreement shall remain in full force and effect and is hereby ratified and reaffirmed.

4. **IN WITNESS WHEREOF**, the parties have executed this Seventh Amendment as of the Seventh Amendment Date.

SELLER:

THE POLICE CREDIT UNION OF CALIFORNIA,
a California nonprofit corporation

DocuSigned by:
By: Eddie Young
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Eddie Young, President & CEO

Date: 3/1/2021

BUYER:

TENDERLOIN NEIGHBORHOOD DEVELOPMENT CORPORATION,
a California non-profit public benefit corporation

DocuSigned by:
By: Donald S. Falk
Donald S. Falk, Chief Executive Officer

Date: 3/1/2021

QUALIFICATIONS OF SARA A. COHN, MAI
California Certified General Real Estate Appraiser No. AG014469

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Sara A. Cohn is a Partner with Watts, Cohn and Partners, Inc. a new firm providing commercial real estate valuation. From 1988 to 2016, she worked for Carneghi and Partners and was a Senior Project Manager/Partner in their San Francisco office. Carneghi and Partners, and now Watts, Cohn and Partners, provide real estate appraisal and consulting services in the San Francisco Bay Area. Clients include financial institutions, government agencies, law firms, development companies and individuals. Typical assignments include both valuation and evaluations of a broad variety of property types, uses and ownership considerations.

Ms. Cohn has over 30 years of appraisal experience. She has completed a wide variety of valuation and evaluation analyses. Ms. Cohn has extensive knowledge of the San Francisco Bay Area and has appraised many property types including office buildings, industrial properties, retail centers, hotels, residential projects, mixed-use properties and development sites. Recent work has involved the analysis of commercial buildings, residential subdivisions, valuation of affordable housing developments with bond financing and/or Low-Income Housing Tax Credits (LIHTCs), assessment districts, as well as co-housing projects.

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Successful completion of all professional appraisal courses offered by the Appraisal Institute as a requirement of membership.

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Continuing Education Requirement Complete

State of California Certified General Real Estate Appraiser No. AG014469
Certified Through March 2021

State of California Licensed Landscape Architect No. 2102

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Seminars Co-Chair, Northern California Chapter of the Appraisal Institute, 2005-2007

Business, Consumer Services & Housing Agency

BUREAU OF REAL ESTATE APPRAISERS

REAL ESTATE APPRAISER LICENSE

Sara A. Cohn

has successfully met the requirements for a license as a residential and commercial real estate appraiser in the State of California and is, therefore, entitled to use the title:

"Certified General Real Estate Appraiser"

This license has been issued in accordance with the provisions of the Real Estate Appraisers' Licensing and Certification Law.

BREA APPRAISER IDENTIFICATION NUMBER: AG 014469

Effective Date: March 10, 2021
Date Expires: March 9, 2023

Loretta Dillon

Loretta Dillon, Deputy Bureau Chief, BREA

3054812

THIS DOCUMENT CONTAINS A TRUE WATERMARK - HOLD UP TO LIGHT TO SEE "CHAIN LINK"

Board of Supervisors
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

Dear Supervisors:

I am the financial representative from Mid Sunset Neighborhood Association (MSNA) writing with regard to Resolution # 210763. The following information was not part of the record considered by the Budget and Finance Committee on 7/15/21, and should be considered by the full Board before it approves resolution #210763 on 7/20/21 for the loan at 2550 Irving.

The appraisal (attached) is fatally and fundamentally flawed in its methodology and would not hold up to peer review according to an experienced commercial appraiser who reviewed it.

Below are the flaws identified by the expert appraiser:

(1) It states in the cover letter that this is a fee simple appraisal. However, on page 30 it states that the appraisal assumes entitlements which would make it a hypothetical appraisal.

(2) The appraisal fails to state the list price for the property and how many offers were made. This further lacks credibility.

(3) The appraisal does not account for the additional cost of remediation. This is a factual error. It stated that, "Upon inspection of the subject site, the appraiser did not observe any toxic contamination on the property....There is also an estimated $120,000 in environmental mitigation costs for soil removal and a vapor intrusion mitigation system." In the draft response plan which was not made available to the Budget and Finance Committee and not part of the record, TNDC recommended $799k for remediation plus $500k for monitoring costs. (In Paul Holzman's attached letter summarizing the environmental issues and why the Board cannot rely on DTSC approving the draft response plan after the comment period closes, Mr. Holzman explains why the costs are unknown and may be significantly more.)

(4) Comps 1, 2, 4, and 5 are not proper comps for 2550 Irving. Comp 4 is government purchased with entitlements in place. Comp 2 is where the City is going to buy the property. Comp 1 is in a much better neighborhood than 2550 Irving and was bought with entitlements in place. Comp 5 is in a much better neighborhood.

(5) Comp 3 decreased the purchase price after toxic contaminants were found. Comparably, the appraisal for 2550 Irving would be decreased at least 20 percent.

If the resolution is approved and the City commits to financing $14.3 million for acquisition and predevelopment, the faulty appraisal will not pass scrutiny of the California Tax Credit Allocation Committee (CTCAC) and other lenders.

Sincerely,
Joan Klau, Mid Sunset Neighborhood Association

CC:
linda.wong@sfgov.org
john.carroll@sfgov.org
lisa.lew@sfgov.org
bos.legislation@sfgov.org

Attachments:
Paul Holzman's letter
Draft Response Plan, available at https://app.box.com/s/7pw2xg66muepst387q78quwiro68xmd4
6/7/21 appraisal

Supervisor Connie Chan
1 Dr. Carlton B. Goodlett Place
City Hall, Room 244
San Francisco, Ca. 94102-4689

July 19, 2021

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6/7/21 appraisal

DEPARTMENT OF TOXIC SUBSTANCES CONTROL
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

PROVEN TECHNOLOGIES AND REMEDIES GUIDANCE

REMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS IN VADOSE ZONE SOIL

APRIL 2010

PREFACE

The Department of Toxic Substances Control (DTSC) is issuing this Proven Technologies and Remedies (PT&R) guidance for immediate use on cleanups at hazardous waste facilities and Brownfields sites. The PT&R approach described herein is an option for expediting and encouraging the cleanup of sites with elevated concentrations of chlorinated volatile organic compounds (cVOCs) in the vadose zone. The approach is designed to ensure safe, protective cleanup and to maintain DTSC's commitment to public involvement in our decision-making process. Please see Chapters 1 through 3 for details regarding the PT&R approach and how to determine whether this guidance is suitable for a given site.

DTSC fully expects that application of the PT&R approach to cleanup of sites with cVOCs in the vadose zone will identify areas that can be improved upon as well as additional ways to streamline the PT&R cleanup process. As the protocols in this document are implemented, issues may be identified which warrant document revision. DTSC will continue to solicit comments from interested parties for a period of one year (ending April 30, 2011). At that time, DTSC will review and incorporate changes as needed.

Comments and suggestions for improvement of *Remediation of Chlorinated Volatile Organic Compounds in Vadose Zone Soil* should be submitted to:

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ACKNOWLEDGMENTS

This document was developed by the Department of Toxic Substance Control under the direction of Mr. Maziar Movassaghi, Acting Director and Mr. Stewart Black, Acting Deputy Director of the Brownfields and Environmental Restoration Program. Without their support, completion of this guidance would not have been possible.

The preparation of this guidance was achieved through the efforts of many individuals. The following people had primary responsibility for writing:

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Ms. Barbara Renzi, Associate Toxicologist
Mr. Peter Ruttan, Engineering Geologist
Mr. Stephen Sterling, Sr. Engineering Geologist

This guidance has benefited greatly through input received from several sources, including:

- DTSC's Proven Technologies and Remedies Team;
- Director's Brownfields Revitalization Advisory Group;
- Internal reviewers of draft versions of the guidance; and
- External peer reviewers of the draft guidance.

In particular, the authors wish to thank the following individuals for their thoughtful technical support throughout the development of this guidance: Dan Gallagher, Lorraine Larsen-Hallock, Janet Naito, Debbie Oudiz, and Jesus Sotelo. The authors would also like to thank the following individuals for their contributions: Tizita Bekele, Jeff Brown, Michelle Dalrymple, Mike Finch, Bruce Garbaccio, Jose Marcos, Greg Neal, Paul Pongetti, Kathaleen Reed, and Will Rowe.

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ABBREVIATIONS AND ACRONYMS

AFCEE	Air Force Center for Engineering and the Environment
ARARs	applicable or relevant and appropriate requirements
ASTM	ASTM International (formerly known as American Society of Testing and Materials)
bgs	below ground surface
Cal/EPA	California Environmental Protection Agency
Cal-OSHA	California Division of Occupational Safety and Health
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHHSLs	California Human Health Screening Levels
CMS	Corrective Measures Study
COC	chemical of concern
CSM	conceptual site model
cVOC	chlorinated volatile organic compound
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EDRP	excavation, disposal, and restoration plan
EE/CA	engineering evaluation/cost analysis
FS	Feasibility Study
HASP	health and safety plan
HSAA	Hazardous Substances Account Act
HWCL	Hazardous Waste Control Law
IC	institutional control
ITRC	Interstate Technology and Regulatory Council
LARWQCB	Los Angeles Regional Water Quality Control Board
LDR	land disposal restriction
LUC	Land Use Covenant
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance

ABBREVIATIONS AND ACRONYMS (Continued)

PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PT&R	proven technologies and remedies
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RAP	Remedial Action Plan
RAO	remedial action objective
RAW	Removal Action Workplan
RCRA	Resource Conservation and Recovery Act
RSL	USEPA Regional Screening Level
RWQCB	Regional Water Quality Control Board
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
SWPPP	storm water pollution prevention plan
SWRCB	State Water Resources Control Board
TCE	trichloroethene
TPH	total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

EXECUTIVE SUMMARY

Widely used in the United States since the 1940s, chlorinated volatile organic compounds (cVOCs) are associated with a variety of uses, such as degreasing, cleaning, manufacturing processes, and dry cleaning operations. Approximately 15 percent of projects managed by the Department of Toxic Substances Control's (DTSC's) Brownfields and Environmental Restoration Program encounter cVOCs. Table ES-1 summarizes cVOCs commonly found during these environmental cleanup projects. Typically composed of one to two carbon atoms and one to six chlorine atoms (ESTCP, 2008), the properties of cVOCs allow wide dispersal in the environment and impacts to multiple environmental media (e.g., soil, soil vapor, groundwater, indoor air). A critical pathway for health risk assessment associated with cVOCs involves the potential health risks from indoor air exposures.

Table ES-1 Commonly Encountered Chlorinated VOCs

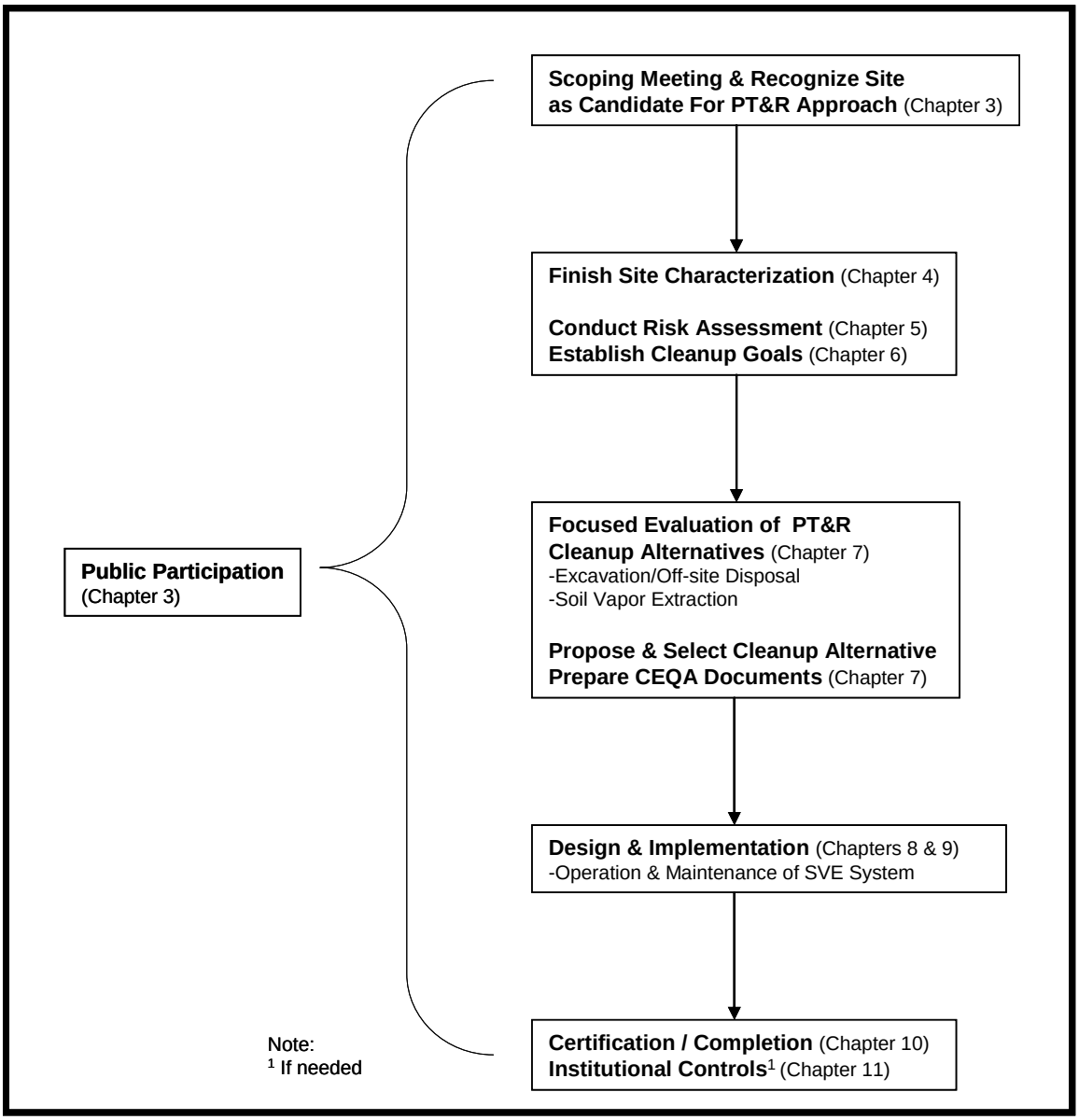
Carbon tetrachloride	1,1-Dichloroethane	1,1,2,2-Tetrachloroethane
Chlorobenzene	1,2-Dichloroethane	**Tetrachloroethylene**
Chloroethane	1,1-Dichloroethylene	**1,1,1-Trichloroethane**
Chloroform	1,2-Dichloroethylene	1,1,2-Trichloroethane
Chloromethane	1,2-Dichloropropane	**Trichloroethylene**
1,2-Dichlorobenzene	Ethylene dibromide	1,2,3-Trichloropropane
1,4-Dichlorobenzene	Methylene chloride	Vinyl chloride
Dichlorodifluoromethane	1,1,1,2-Tetrachloroethane	

Notes:
Table is not intended to be an all-inclusive list of cVOCs.
Bold indicates most commonly encountered cVOCs on DTSC cleanup projects.

DTSC has prepared this *Proven Technologies and Remedies Guidance – Remediation of Chlorinated Volatile Organic Compounds in Vadose Zone Soil* (PT&R guidance) as an option for expediting and encouraging cleanup of sites with elevated concentrations of cVOCs in vadose zone soil. The PT&R approach for cVOCs discussed herein (Figure ES-1) may be applied at operating or closing hazardous waste facilities and at Brownfields sites. This PT&R guidance can be used by any government agency, consultant, responsible party, project proponent, facility operator, and/or property owner addressing cVOCs in soil. Although expediting cleanup is emphasized, the PT&R approach is designed to ensure safe, protective remediation and to maintain DTSC's commitment to public involvement in our decision-making process.

Cleanup of contaminated sites may be governed by one or more federal or State laws, depending on such factors as the source and cause of the contamination, the type of chemical contamination found, and the type of operations conducted. The PT&R approach is consistent with these laws and will yield technically and legally adequate environmental solutions. The PT&R approach is also consistent with the U.S. Environmental Protection Agency (USEPA) presumptive remedy guidance (USEPA, 1996, 1997a).

Figure ES-1. General Overview of PT&R Approach for Sites with Vadose Zone Soils Impacted by Chlorinated VOCs.



This PT&R guidance is applicable on a case-by-case basis at sites where the remedial action objective (RAO) is to address vadose zone soils (i.e., unsaturated soils above the groundwater table) contaminated with cVOCs. The PT&R guidance will not be applicable to all sites with cVOC contamination in soil. Prior to applying this guidance to a site cleanup process, DTSC should be consulted and should concur with the use of the PT&R approach.

The results achieved through implementing the PT&R approach will depend on the site-specific RAOs which could range from removing as much cVOC mass as feasible during an interim removal action to achieving risk-based cleanup goals as part of the final remedy. The outcome of applying the PT&R approach may be the completion of an interim removal action, cleanup to levels that require on-going controls, or certification of the site for unrestricted use.

The PT&R approach (Figure ES-1) streamlines the cleanup process by (1) limiting the number of evaluated technologies to two PT&R alternatives; (2) facilitating remedy implementation; and (3) facilitating documentation and administrative processes. DTSC identified the two PT&R alternatives by conducting a study that reviewed and screened data for 90 sites throughout California where the primary contaminants were cVOCs in soil and where DTSC provided oversight of the soil cleanup. This study found that "excavation and off-site disposal" and "soil vapor extraction" (SVE) were the most frequently selected cleanup alternatives and therefore these remedies were selected as the PT&R alternatives for cVOCs in soil.

The objectives of this PT&R guidance are to:

- identify the types of sites that would be appropriate for application of the PT&R approach;
- identify the site data that should be collected to support the PT&R approach;
- provide an overview of guidance in characterizing risk and establishing cleanup goals;
- provide guidance for designing and implementing the PT&R alternatives; and
- provide sample documents, annotated outlines, and examples for the documents prepared as part of the cleanup process.

This PT&R guidance is not intended to replace the evaluation of innovative and new technologies. DTSC continues to encourage the use and evaluation of emerging technologies.

OVERVIEW OF PT&R APPROACH

Figure ES-1 and the following paragraphs summarize the steps of the PT&R approach. The PT&R approach uses the public participation process identified in the *DTSC Public Participation Policies and Procedures Manual* (DTSC, 2003).

Determine Suitability for PT&R Approach. To determine whether the PT&R approach is appropriate for a specific site, an evaluation should be conducted to determine whether the site characteristics make it amenable to the PT&R approach. Site characteristics that favor the PT&R approach are summarized in Table ES-2. Most notably, this PT&R guidance targets cleanup at sites where the primary environmental issue is cVOC contamination in vadose zone soils. Refer to Chapter 3 for details regarding these characteristics.

Table ES-2. Site Characteristics that Favor PT&R Approach

- Primarily cVOC contamination
- Ability to address any groundwater impacts through a separate remedial technology
- Soil impacts that can be addressed by excavation/disposal or SVE
- No emergency actions required
- No ecological habitat or sensitive receptors impacted[1]
- Exposure pathways and land use scenarios consistent with PT&R approach[1]

Note:
1 The approach recommended for selection of cleanup goals in this PT&R guidance considers the human health impacts of cancer risk and noncancer hazard for residential and industrial/commercial land use exposure scenarios (see Chapter 5 for details). If a site has potential impacts to ecological receptors or surface water, the PT&R approach is not applicable.

Characterization Phase. The characterization phase establishes the nature and extent of contamination in environmental media such as soil and soil gas. Under the PT&R approach, sufficient data should be collected to determine that the PT&R approach is applicable as well as to support any fate and transport modeling, risk assessment, remedy selection, and the engineering design. As data are gathered, they are evaluated to help determine whether further site characterization, risk assessment, or cleanup may be necessary.

Risk Assessment. Evaluation of potential risks to human health and the environment posed by contaminants at the site is part of the site characterization process and supports the risk management decision-making process. Depending on when a site begins using the PT&R approach, some risk assessment steps may have already been conducted and may be sufficient to support subsequent activities. A human health risk assessment is conducted to characterize potential cancer risks and noncancer health hazards. A scoping level ecological risk investigation is conducted to evaluate the potential for complete exposure pathways between ecological receptors and constituents of concern. Sites requiring further ecological assessment are beyond the scope of this PT&R guidance. The risk to groundwater quality is evaluated using measured groundwater concentrations and/or groundwater concentrations predicted by fate and transport modeling. The results of the risk assessments are used to establish appropriate site-specific RAOs and risk-based cleanup goals.

Site-Specific Evaluation and Selection of Remedial Alternatives. The remedy selection document is drafted in accordance with the requirements applicable to the site/facility. The alternative evaluation should demonstrate that the RAOs identified for the site can be met. The alternatives would generally include no action, excavation/

disposal, and/or SVE. The necessary California Environmental Quality Act (CEQA) documents may be prepared concurrently with the remedy selection document. Typically, the draft remedy selection and CEQA documents are circulated concurrently for public comment. The SVE alternative will require on-going operation and maintenance (O&M) until the RAOs are achieved, and therefore will require a regulatory oversight agreement.

Cleanup Design and Implementation. The technical and operational plans for implementing the proposed alternative may be included in the remedy selection document, if appropriate, or prepared as a separate document once a final response action is approved. Once the final response action is implemented, a report documenting its implementation is submitted to DTSC. There are several types of response action documents which may be applied to the PT&R approach, as discussed further in the main text of this PT&R guidance.

Certification / Completion. When the approved remedy for cVOCs in the vadose zone has been fully implemented, DTSC will determine through performance metrics (including confirmation sampling) whether the RAOs established in the remedy decision document have been achieved. The possible determinations are: the RAOs have been achieved; the response action has been fully implemented, is operating successfully, and on-going O&M is needed until the RAOs are achieved; and/or additional remediation is necessary. Based on these findings, DTSC will issue a certification letter, a completion letter, or a letter requiring additional work to address cVOCs in the vadose zone.

Long-term Stewardship. Long-term stewardship applies to sites and properties where management of contaminated environmental media is necessary to protect human health and the environment over time. On-going controls (such as institutional controls for contamination remaining in place) and other measures will be needed, as discussed further in Chapter 11.

1.0 INTRODUCTION

Chlorinated volatile organic compounds (cVOCs) are encountered by approximately 15 percent of cleanup projects managed by the Department of Toxic Substances Control's (DTSC's) Brownfields and Environmental Restoration Program. Widely used in the United States since the 1940s, cVOCs are associated with a variety of uses, such as degreasing, cleaning, manufacturing processes, and dry cleaning operations. These compounds are also present in some household products and automobile fluids. Releases to the environment have occurred through various mechanisms, including surface discharges, leaking underground storage tanks, and inadequate disposal practices. Unfortunately, cVOCs have properties that make them disperse widely in the environment. Their volatile nature leads to the formation of vapor plumes in soil. Small quantities of cVOCs can contaminate large volumes of water at concentrations exceeding health risk screening levels and can persist as sources of on-going contamination for long periods of time. When released as free product, cVOCs can migrate downward to significant depths (potentially hundreds of feet) and through fine grained deposits. In addition, cVOC vapors can migrate upwards to the surface and produce elevated concentrations within indoor air spaces. Potential health risks from indoor air exposures are a critical pathway for health risk assessment.

This *Proven Technologies and Remedies Guidance – Remediation of Chlorinated Volatile Organic Compounds in Vadose Zone Soil* (PT&R guidance) has been prepared to streamline the cleanup process (a generic term used to refer to corrective action and remedial action cleanup processes) at sites with vadose zone soils contaminated with cVOCs. The proven technologies and remedies (PT&R) alternatives discussed in this PT&R guidance were determined to be effective based on:

- engineering and scientific analysis of performance data from past State and federal cleanups and
- review of the administrative records and procedures used to implement the technologies.

This PT&R guidance is one of three documents developed under DTSC's PT&R efforts that outline an option for streamlining the cleanup process, thus increasing the number of acres that are cleaned up and returned to beneficial use. Analogous documents pertaining to metals and organochlorine pesticides in soil can be obtained from the DTSC Web-site (www.dtsc.ca.gov/SiteCleanup/PTandR.cfm). The PT&R approach described herein can be applied to operating or closing hazardous waste facilities and to Brownfields sites. Although expediting the cleanup process is emphasized, the PT&R approach is designed to ensure safe and protective remediation.

1.1 PURPOSE AND OBJECTIVE

The purpose of this PT&R guidance is to encourage and support the use of DTSC's experience and to provide guidance on PT&Rs for expedited cleanup of sites with cVOCs in vadose zone soil. The PT&R guidance is intended for use by any government agency, consultant, responsible party and/or property owner addressing

potential cVOC contamination at a site. Prior to applying this PT&R guidance to a site cleanup process, the oversight agency must be consulted and must concur with use of the PT&R approach.

The objectives of the PT&R guidance are to:

- identify the characteristics that make a site conducive for application of the PT&R approach for cVOCs;
- provide recommendations for characterizing the nature and extent of contamination and collecting data needed to support the cleanup alternative evaluation;
- summarize guidance for characterizing risk and establishing cleanup goals;
- focus the site-specific evaluation of cleanup alternatives to the PT&R alternatives;
- provide guidance for post-cleanup evaluation to characterize the residual cVOC concentrations; and
- provide guidance on associated administrative requirements, such as documentation and implementation of the cleanup alternative selection process.

As discussed further in Section 1.3, the degree of cleanup achieved through implementing the PT&R approach will depend on the site-specific remedial action objectives (RAOs). Possible results of implementing the PT&R approach could include mass removal to the extent feasible, cleanup to levels requiring on-going controls, or cleanup to levels allowing unrestricted use.

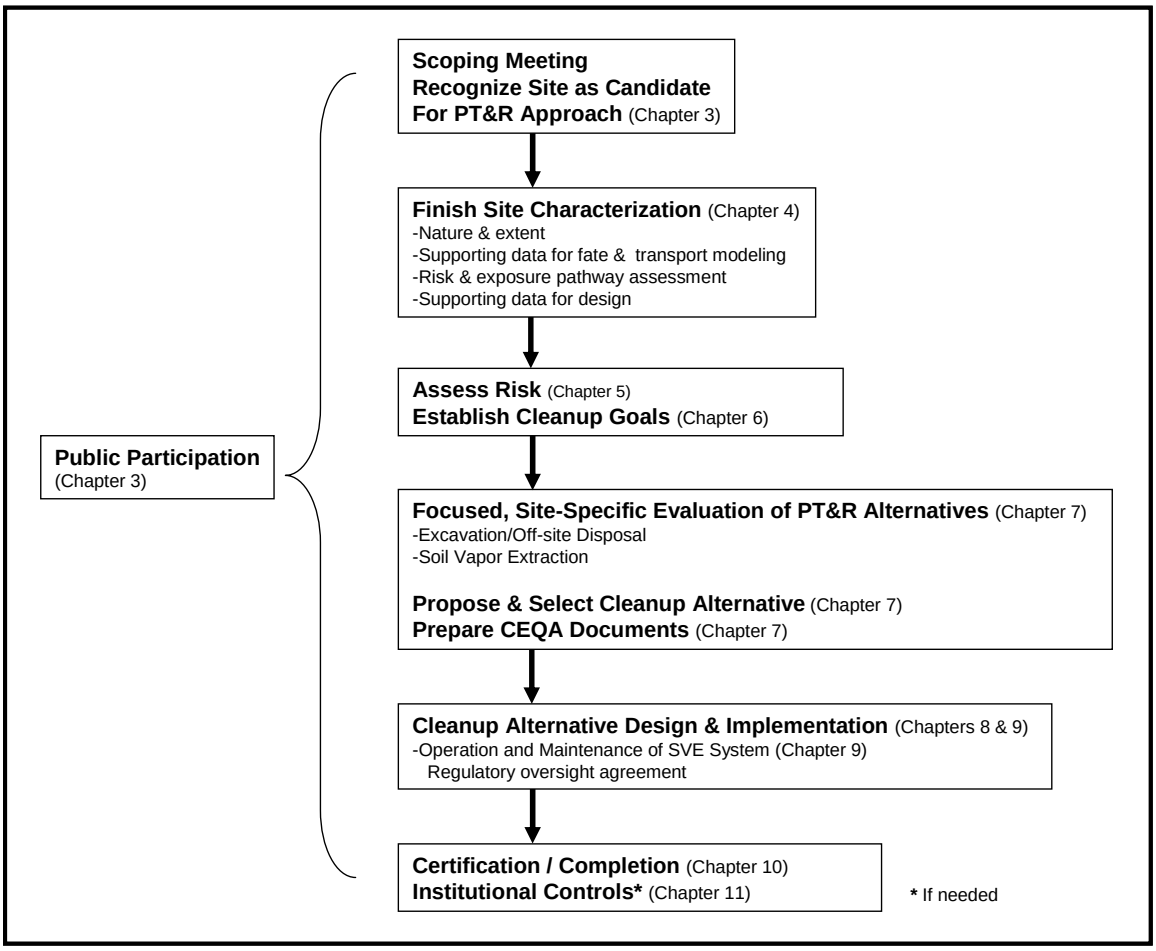
As illustrated in Figure 1, the PT&R approach follows typical steps used by standard cleanup processes. Because sites can begin applying the PT&R approach at various stages in the cleanup process, some topics discussed in this PT&R guidance may not be applicable to a given site. For example, risk characterization completed prior to initiating the PT&R approach could be used to support subsequent steps of the cleanup process. If risk characterization has not previously been conducted prior to using the PT&R approach, the approach described in Chapter 5 can be used to characterize the risk.

1.2 TECHNICAL BASIS FOR PT&R APPROACH AT SITES WITH VADOSE ZONE SOIL CONTAMINATED WITH CHLORINATED VOCs

DTSC conducted a study that reviewed and screened data for 90 sites where the primary contaminants were cVOCs in vadose zone soils (see Section 7.1 for details). The study identified the technologies that were consistently evaluated and technologies that were subsequently selected as the remedy. The results of the DTSC study revealed that “excavation and offsite disposal” (excavation/disposal) and/or “soil vapor extraction” (SVE) were the most frequently selected cleanup alternatives. Hence, excavation/disposal and SVE were selected as the PT&R alternatives for cVOCs in vadose zone soil.

The study also revealed that most sites had cVOC impacts to both vadose zone soil and groundwater. This typically resulted in selection of excavation/disposal and/or SVE to address the soil impacts and selection of another remedy to address the groundwater plume. Because groundwater cleanup times can be considerably longer than times for soil cleanups, the soil cleanup action was often implemented as an interim removal action to quickly address cVOC mass posing an on-going threat to groundwater.

Figure 1. PT&R Approach for Sites With Chlorinated VOCs in Vadose Zone Soil.



1.3 SCOPE AND APPLICABILITY

This PT&R guidance is designed to assist with the cleanup of cVOCs in vadose zone soil. The results achieved will depend on the site-specific RAOs and the overall purpose of implementing the PT&R approach (e.g., interim removal action, final remedy). A RAO could consist of removing as much cVOC mass as feasible during an interim removal action (such as to decrease the amount of cVOC mass migrating

toward groundwater). When implemented as the final remedy, RAOs may establish risk-based cleanup goals to be achieved by the removal action. As applicable, the PT&R approach should be coordinated with the groundwater remedy so that cVOCs in groundwater do not recontaminate vadose zone soils and vice versa. The outcome of applying the PT&R approach may be the completion of feasible mass removal, cleanup to levels that require on-going controls, or certification of the site for unrestricted use.

As discussed further in Section 3.2, this guidance is intended for sites that meet the following conditions:

- cVOCs are the primary contaminant of concern;
- no emergency or time-critical removal actions required;
- cVOC impacts to unsaturated soil can be addressed by excavation/disposal and/or SVE;
- groundwater impacts can be addressed by a separate remedial technology; and
- exposure pathways, receptors (human health), and land use scenarios (residential, industrial/commercial) applicable to the site are consistent with the PT&R approach (see Chapter 5 for details).

The PT&R approach is not applicable to all sites with cVOC impacts to soil. As discussed further in Section 3.3, the PT&R approach for cVOCs may not be appropriate for sites with:

- mixtures of contaminants (e.g., more complex treatment may be required);
- shallow bedrock;
- ecological habitat or sensitive receptors; and
- surface water features.

If any of these conditions are present, this PT&R guidance may not be appropriate for the site and a more extensive cleanup technology evaluation should be conducted.

DTSC continues to encourage the use and evaluation of emerging technologies and therefore this PT&R guidance is not intended to replace evaluation of innovative and new technologies.

2.0 OVERVIEW AND ORGANIZATION

Cleanup of contaminated sites may be governed by one of several federal or State laws, including the:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Resource Conservation and Recovery Act (RCRA)
- Hazardous Waste Control Law (HWCL)
- Hazardous Substances Account Act (HSAA)

The law applicable to a given site depends on such factors as the source, cause of the release, and cleanup process under which the site is being addressed. The PT&R approach operates consistently with these laws and will yield technically and legally adequate environmental solutions. Any procedural differences between cleanup authorities will not substantively affect the outcome of the cleanup. The remedies evaluated and selected must be: (1) protective of human health and the environment; (2) able to achieve RAOs and cleanup goals; and (3) able to control or remediate sources of releases.

The PT&R approach (Figure 1) is consistent with DTSC's conventional cleanup processes through which sites undergo:

- site characterization (also referred to as site investigation);
- risk assessment;
- remedy screening and evaluation, such as under a Feasibility Study (FS) or Corrective Measures Study (CMS);
- remedy selection; and
- implementation of the corrective action and/or remedial action.

The PT&R approach streamlines the remedy screening, evaluation, and selection phases. In addition to being used as guidance for selecting the final remedy for a site, the PT&R approach is also suitable for interim removal actions to prevent or minimize the spread of contamination while final cleanup action alternatives are being evaluated. Because the PT&R guidance identifies excavation/disposal and SVE as the preferred alternatives, the data needed to support the remedy selection phase are potentially focused and reduced, thus decreasing time and investigation costs.

The use of the guidance document may have the following benefits:

- **Time and cost savings**. The guidance streamlines the cleanup process by (1) limiting the number of evaluated technologies; (2) facilitating corrective action and/or remedial action implementation by providing samples and annotated outlines for key documents; and (3) facilitating documentation and administrative processes.

- **Focused site characterization to support cleanup design**. Data needed to support the cleanup design is collected during site characterization activities. Preferably, the PT&R approach should be initiated as early as possible in the assessment and/or characterization phase.

- **Focused remedy selection**. The evaluation of cleanup alternatives is focused on the two most commonly implemented alternatives.

- **Transparent process**. Stakeholders are identified and involved early and throughout the cleanup process.

The PT&R guidance is organized into twelve chapters:

Chapter 1 presents introductory information, including the purpose, objective, scope, and applicability of the PT&R guidance.

Chapter 2 provides an overview of the PT&R approach and summarizes the organization of the PT&R guidance.

Chapter 3 summarizes the site assessment to determine its suitability for the PT&R approach. Community assessment is also discussed.

Chapter 4 identifies site characterization objectives and identifies key reference materials for characterization activities.

Chapter 5 summarizes risk assessment approaches.

Chapter 6 describes the development of cleanup goals, risk management considerations, evaluation of short-term risks during remedy implementation, and post-cleanup risk evaluation.

Chapter 7 summarizes and documents the DTSC study that is the basis for the PT&R alternatives. This chapter also addresses the focused evaluation and selection of the cleanup alternative.

Chapter 8 summarizes the design and implementation considerations for the excavation/disposal alternative.

Chapter 9 summarizes the design and implementation considerations for the SVE alternative.

Chapter 10 addresses the completion or certification of the remedy for cVOCs in the vadose zone.

Chapter 11 discusses long-term stewardship considerations.

Chapter 12 provides the references cited in this guidance document.

3.0 SITE ASSESSMENT

The PT&R approach is initiated by assessing whether this guidance may be applied to a given site with cVOCs in vadose zone soil. As discussed in Section 3.1, the decision to apply the PT&R approach can be made in a project scoping meeting between DTSC and project proponents. A potential outcome of the scoping meeting might be that the PT&R approach is not appropriate for the site and that standard DTSC cleanup processes should be implemented.

Because it was not realistic to develop a guidance document that addresses every possible site scenario, Sections 3.2 and 3.3 identify favorable site characteristics and potential limitations for applying the PT&R approach. The presence of limitations does not necessarily preclude use of the PT&R approach. If limitations are identified, DTSC and project proponents would make a determination as to whether it is appropriate and worthwhile to apply the PT&R approach with site-specific adjustments.

3.1 PROJECT SCOPING

The project scoping objectives under the PT&R approach are the same objectives that are used under any DTSC cleanup process. These objectives include:

- establishing a management approach for the project;
- developing a site cleanup strategy which is protective of human health and the environment;
- developing a project plan (i.e., the step-by-step strategy to be used for the site cleanup);
- recognizing unique site conditions to be addressed during the cleanup process (e.g., cultural resources, sensitive human receptors);
- identifying and assessing stakeholders; and
- scoping public participation activities.

3.1.1 Scoping Meetings

DTSC staff and project proponents should hold one or more project scoping meetings. Typical discussion topics during these meetings include:

- site background, physical setting, current/past land uses, and unique site characteristics;
- status of site investigation and cleanup;
- conceptual site model (CSM; i.e., types and locations of releases, affected environmental media [e.g., soil, soil vapor, groundwater, indoor air], contaminant migration pathways, current and potential future receptors, exposure pathways [e.g., direct contact, inhalation, vapor intrusion into indoor air, drinking water], potential risks);

- regulatory framework for site cleanup;
- initial scope of work for completing site characterization, filling data gaps, and cleaning up the site;
- potentially applicable remedial technologies;
- preliminary identification of response actions and the implications of these actions (e.g., restricted land use, long-term stewardship);
- preliminary RAOs and cleanup goals;
- project planning, phasing, scheduling, and priorities; and
- stakeholder identification and public participation activities.

The scoping meeting would determine if the PT&R approach may be applied to all or part of the site cleanup, either as described in this PT&R guidance document or with site-specific adjustments (see Section 3.4). If the PT&R guidance is appropriate, the intended outcome of implementing the PT&R approach (e.g., mass removal, unrestricted use) and any long-term stewardship requirements associated with the contemplated cleanup approach should be addressed. If applicable, the scoping meeting should address how the PT&R approach for cVOCs in vadose zone soil will be coordinated with the groundwater remedy and/or vapor intrusion mitigation measures.

The outcome of the scoping meeting(s) may be summarized in a scoping document that includes:

- analysis and summary of site background and physical setting;
- summary of previous response actions, including all existing data;
- presentation of the CSM, human health risks, and data gaps;
- scope and objectives of remaining characterization and risk assessment activities;
- scope and objectives of the site cleanup;
- RAOs and cleanup goals;
- preliminary identification of possible response actions and data needed to support the evaluation of cleanup alternatives; and
- initial presentation of site remedial strategies (e.g., decision to apply the PT&R approach, coordination between PT&R approach and groundwater remedy).

3.1.2 Stakeholder Identification and Assessment

Stakeholder involvement is considered essential for the success of any cleanup action. At the onset of the proposed project, stakeholders should be identified and contacted for input. Stakeholders include any individuals, government organizations, environmental and other public interest groups, academic institutions, and businesses with an interest in the project. The identification of stakeholders is largely based on those entities or individuals who are already involved in the project, and contacting others with related

interests or those who may be in close proximity to the site. Stakeholders provide information on the preferences of the community and may also identify unaddressed issues. Early identification of stakeholders is necessary to ensure effective and timely participation to meet stakeholder expectations, and to improve the decision-making process.

3.1.3 Public Participation Activities

The PT&R approach acknowledges the importance of early community outreach and uses the public participation process identified in the *DTSC Public Participation Policies and Procedures Manual* (DTSC, 2003). The manual addresses public participation components of the cleanup process and compliance with State and federal laws and regulations. Summaries of the public participation elements for each DTSC program, California Environmental Quality Act (CEQA), and various public outreach activities are included. Also provided are checklists and recommended content for the public participation plan, fact sheets, public notices, and other public outreach activities. A link to sample public participation documents is provided in Appendix D.

The vapor intrusion pathway may be a concern for some cVOC sites. The public participation process should begin as soon as it is determined that cVOCs are present and a vapor intrusion evaluation is necessary. The *Vapor Intrusion Mitigation Advisory* (DTSC, 2009a) outlines public participation considerations for sites with vapor intrusion issues.

3.2 SITE CHARACTERISTICS THAT FAVOR THE PT&R APPROACH

This PT&R guidance is intended for remediation at sites where the primary environmental issue is cVOCs in vadose zone soil. The site characteristics summarized in Table 1 favor application of the PT&R approach.

3.3 SITE CHARACTERISTICS THAT MAY LIMIT THE USE OF THE PT&R APPROACH

Table 2 summarizes site conditions that may limit application of the PT&R approach. Additional rationale for the limiting characteristics is provided in the following paragraphs. Some of the limiting characteristics described below may not be applicable if the PT&R approach is being used as an interim removal action.

3.3.1 General Characteristics

Time-Critical Cleanup/Emergency Response Actions. The approach used for time-critical cleanup or emergency response actions (i.e., removal actions that are imminent and must be carried out immediately) will be more streamlined than the PT&R approach and will be subject to different regulatory requirements than non-time critical cleanup actions.

Potential Ecological Risk. Sites located in areas that are designated as environmentally sensitive (e.g., wetland areas, wildlife refuges, endangered species habitat), or that have other characteristics that suggest potential ecological impacts, are not candidates for the PT&R approach. Ecological risks may be present at sites where potential habitat, ecological receptors, surface water drainages, and/or surface water features are present. Because the cleanup process may be more complex (including the development of appropriate cleanup goals and potential ecological impacts by implementation of the remedy), these types of sites may not be suitable for the PT&R approach.

Surface Water Features. Sites with surface water may not be suitable for the PT&R approach. Surface water and associated zones of water saturation introduce variability and uncertainty in the distribution, migration, and concentration of cVOCs in soil and soil gas, and complicate the design and implementation of remedies. Also, surface water potentially impacted by runoff or subsurface migration of cVOCs from contaminated soil may be linked to ecological risk or have other risk considerations. The cleanup goals and alternatives recommended by this guidance document do not consider these risks.

Complex Sites. The PT&R approach may not be appropriate for complex sites that require a more elaborate cleanup strategy than is offered by this approach. Large sites may require integration of multiple cleanup approaches and may need to consider ecological risk when selecting the cleanup alternative. Sites with off-site contamination or potential off-site receptors require an evaluation beyond the scope of the PT&R approach.

Table 1. Site Characteristics that Favor the PT&R Approach

Applicable PT&R Alternative(s)	Favorable Characteristic	Primary Rationale for Favorable Characteristic
• Excavation/disposal • SVE	cVOC contamination	• PT&R alternatives are most common remedies used to address cVOCs in vadose zone.
	No emergency actions required	• PT&R approach requires a planning period of at least six months.
	Industrial/commercial or residential land use scenario	• Residential and industrial/commercial exposure scenarios are the most common scenarios evaluated. Standard default assumptions are available.
	Human receptors only	• This guidance addresses health risk cleanup goals for human receptors.
	Groundwater impacts addressed by a separate remedy	• The PT&R alternatives do not directly address groundwater.
• Excavation/disposal	Readily accessible contamination	• Can be the most efficient means of removing impacts to shallow soils. Feasible depth for excavation is a site-specific decision.
	Co-located contaminants	• Likely more feasible if the same excavation activities would remove cVOCs as well as other contaminant types.
• SVE	Conditions conducive to effective SVE	• Conditions for effective SVE: homogeneous, permeable soils; adequate vadose zone thickness; volatile contaminants.

Table 2. Site Characteristics that Limit the PT&R Approach

Applicable PT&R Alternative(s)	Limiting Characteristic	Primary Rationale for Limiting Characteristic
• Excavation/ disposal • SVE	Multiple contaminant groups	• Multiple contaminant groups may be more efficiently cleaned up by alternate approaches.
	Emergency action required	• These actions have different regulatory requirements and require a faster response than can be achieved under the PT&R approach.
	Ecological habitat or sensitive receptors	• If the scoping-level ecological investigation identifies potentially complete exposure pathways, further assessment is necessary and is beyond the scope of this PT&R guidance.
	Potential for surface water impact	• Impacts to surface water may have associated ecological risks. The risk assessment approach recommended by this guidance addresses human health risk only.
	Land use or exposure scenario other than residential or industrial/commercial	• Other land use or exposure scenarios require site-specific evaluation and an adjustment to the PT&R approach. Default exposure assumptions generally are not available.
	Off-site contamination and potential receptors	• Adds complexity to the cleanup process and the evaluation of receptors. Requires an evaluation beyond the scope of this guidance.
• Excavation/ disposal	cVOC impacted soil cannot be excavated	• Excavation is only feasible up to certain depths (based on site-specific considerations). • Site infrastructure or conditions may preclude excavation.
	Multiple contaminant groups	• Multiple contaminant groups may limit disposal options. Multiple excavations required if contaminants are not co-located.
• SVE	Soils with low air permeability	• Fine-grained or high moisture content soils require a higher vacuum and typically require a longer remediation time, which increase the cost of SVE. SVE is not technically feasible in soil with very low permeability where sufficient air flow rates (pore gas velocity) cannot be created.
	Shallow groundwater	• Sites with shallow groundwater may be better addressed via the groundwater remedy.
	cVOC contamination near capillary fringe	• High moisture conditions near the capillary fringe decrease mass removal via SVE.
	Saturated soil	• SVE is not effective under saturated conditions.
	Heterogeneous soil	• Heterogeneity results in lower mass removal rates and prolongs operation time for the SVE system.
	Bedrock	• This guidance does not address SVE in bedrock.
	High soil organic matter content	• cVOCs sorb to soil organic matter, decreasing the mass removal rates and prolonging the operation time for the SVE system.
	Multiple volatile contaminant groups	• Other treatment options may be needed for multiple types of volatile contaminants.
	Non-volatile contaminants	• SVE is more effective for volatile compounds.

3.3.2 Excavation/Disposal

Inaccessible Soil Impacts. Soil impacted with cVOCs may not be accessible by excavation. Each site will have a maximum depth that is feasible for excavation. Some soil impacts may not be accessible because of buildings or other infrastructure. Excavation may be logistically infeasible because of adverse effects on site operations or activities.

Multiple Contaminant Groups. Excavation/disposal may not be suitable for sites that have a mixture of cVOCs and other contaminants and that may be more effectively or efficiently cleaned up by other approaches (such as when the contaminants are not co-located). Additional types of contaminants may affect soil disposal options.

3.3.3 Soil Vapor Extraction

Multiple Contaminant Groups. Mixtures of volatile contaminants generally require more complex SVE treatment systems (e.g., multiple treatments) than are described in Chapter 9. Contaminant matrices, such as high concentrations of oil and grease, pose additional complexities. Non-volatile contaminants cannot be addressed by SVE and would require a separate remedy.

Soil Properties. Low permeability, high soil organic matter content, and heterogeneous soils will have lower mass removal efficiencies. This guidance is not applicable for sites where SVE is being implemented to address cVOCs in bedrock.

Moisture Content. SVE is not effective in saturated soils. Low soil permeability is observed with higher soil moisture content, resulting in decreased mass removal efficiencies. SVE may not be effective in removing cVOC mass near the capillary fringe.

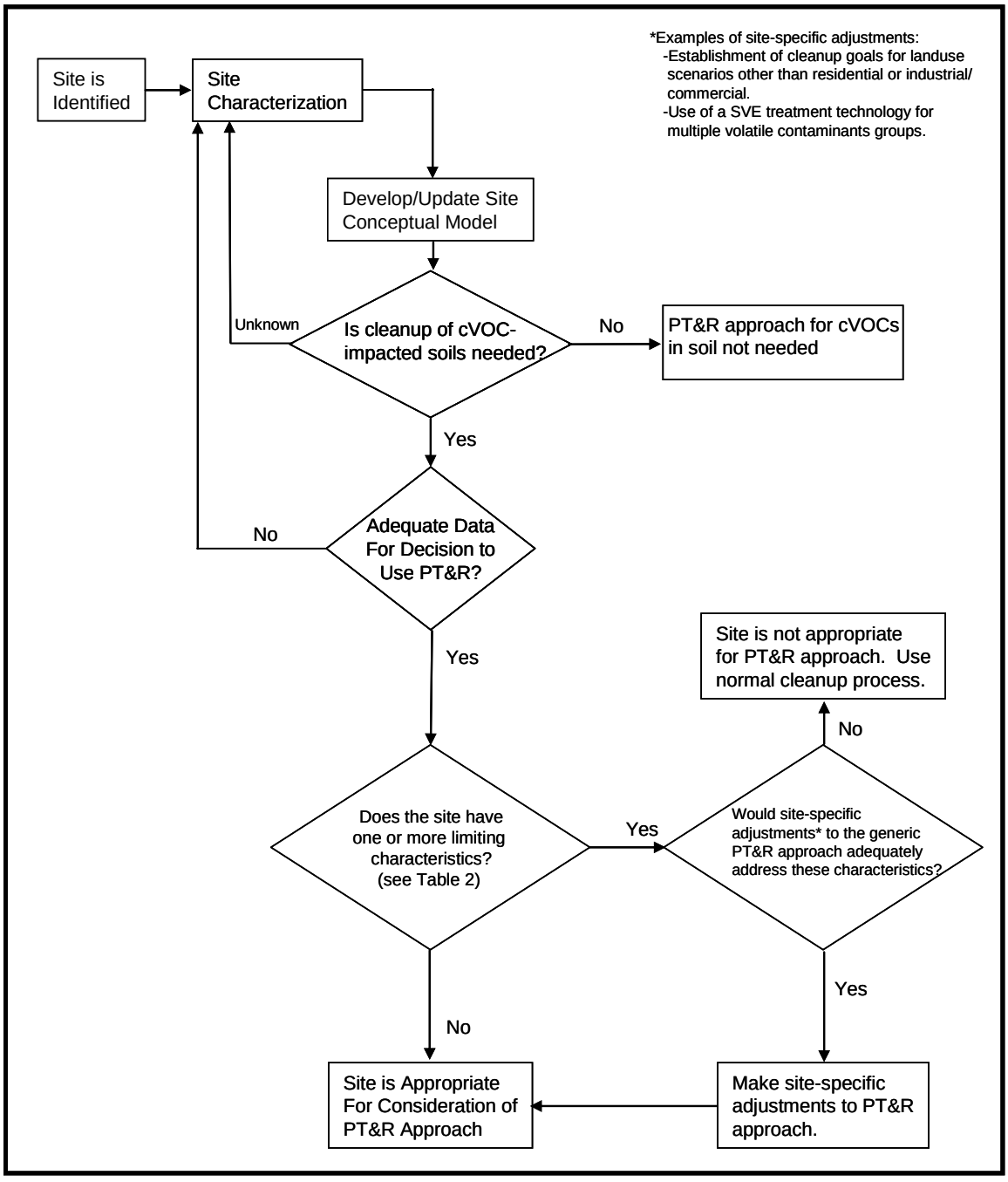
Shallow Groundwater. SVE is typically implemented at sites having sufficient vadose zone thickness to warrant its use. Sites with shallow groundwater may have high soil moisture content in the vadose zone or cVOCs contacting the capillary fringe, both conditions lead to inefficient removal of cVOCs by SVE. At sites with shallow groundwater, one option is to use excavation/disposal to address accessible cVOC-impacted soils and other remedial approaches to address the remaining cVOC mass in the subsurface.

3.4 DETERMINATION OF SUITABILITY FOR PT&R APPROACH

Figure 2 summarizes the recommended process for determining the suitability of the PT&R approach at a site. While a decision to apply the PT&R approach can be made at any point in the cleanup process, a site can be evaluated for suitability under the PT&R approach as soon as information is available that indicates a response action is necessary.

A CSM should be developed to assist with the determination of suitability for the PT&R approach. The CSM is intended to summarize all currently available information about the site, develop a preliminary understanding of the site, and identify data gaps. Appendix A provides the CSM for cVOCs in the subsurface. The identified data gaps should be used to determine whether sufficient information is available to make a decision that a site is suitable for the PT&R approach.

Figure 2. Process for Determining if the PT&R Approach for Chlorinated VOCs in Vadose Zone Soil is Appropriate for a Given Site



4.0 SITE CHARACTERIZATION

The primary objective of the characterization phase is to establish the nature, extent, and distribution of cVOC contamination (Section 4.1). Under the PT&R approach, another objective of the characterization effort is to collect the data needed to support any fate and transport modeling efforts (Section 4.2), and to support the engineering design (Section 4.3). Site characterization activities should be conducted in accordance with a DTSC-approved workplan, including a field sampling plan and a quality assurance project plan (QAPP). Appendix D includes a link to annotated outlines for a characterization phase workplan and a site characterization report.

The site characterization efforts should be designed to produce effective, decision quality data in a manner that is cost effective and timely. The Triad approach to data collection, described in the *Technical and Regulatory Guidance for the Triad Approach: A New Paradigm for Environmental Project Management* (ITRC, 2003), should be considered for sites using the PT&R approach. The *Standard Practice for Expedited Site Characterization of Vadose Zone and Ground Water Contamination at Hazardous Waste Contaminated Sites* (ASTM, 2004) may also be useful. The approaches described in these guidances can focus work towards rapid site characterization decisions. Additional information about the Triad approach can be found at the following link: www.triadcentral.org.

Low-cost passive or real-time measurement technologies (such as passive soil gas sampling, membrane interface probes, grab groundwater sampling) may be useful techniques for characterizing sites with cVOC impacts. These techniques allow for data collection programs covering wider areal or vertical extent over shorter time frames than can be achieved by traditional methods. The techniques can then be followed by higher quality data collection methods (i.e., active soil gas sampling, permanent vapor monitoring well installation, permanent groundwater monitoring well installation) to characterize the site, support the risk assessment, and the remedy design.

The characterization phase should culminate with an updated CSM and an analysis to ensure that the PT&R approach is still applicable (see Chapter 3). Appendix A presents the CSM for cVOCs in the subsurface.

4.1 SOIL, SOIL GAS, AND GROUNDWATER

This section provides brief discussions of investigation strategies and available resources for investigating soil, soil gas, and groundwater. Because numerous guidance documents are available to assist with the design and implementation of site investigations, this guidance does not include an extensive discussion of site characterization.

Soil Gas. Soil gas investigations are useful to obtain vapor phase data at sites potentially affected by volatile contaminants. Both passive and active soil gas data can be useful for site characterization. Where practicable, soil gas sampling is preferred over soil matrix and groundwater sampling for assessing cVOC impacts, including

characterization objectives such as source identification, determining spatial distribution, and assessing potential vapor intrusion risks. Soil gas sampling should consider the *Advisory – Active Soil Gas Investigation* (DTSC and LARWQCB, 2003; revision pending). Please check the DTSC web-site at the following link for updated versions of this advisory: www.dtsc.ca.gov/SiteCleanup/Vapor_Intrusion.cfm.

Soil Matrix. Soil matrix data provide the total cVOC concentration in subsurface soil which may be useful for defining the source location and high concentrations of cVOCs. In addition, soil matrix data are used to evaluate risks associated with direct contact exposure pathways for cVOCs in soil, such as the dermal contact, ingestion, and outdoor-air inhalation pathways. Soil matrix samples should be collected using the procedures described in the *Guidance Document for the Implementation of United States Environmental Protection Agency Method 5035: Methodologies for Collection, Preparation, Storage, and Preparation of Soils to be Analyzed for Volatile Organic Compounds* (DTSC, 2004).

Groundwater. Impacts to groundwater are often observed at sites with cVOC impacts to vadose zone soil and therefore should be evaluated as part of the site characterization activities. The California Environmental Protection Agency (Cal/EPA) has several guidance manuals for groundwater investigations (Cal/EPA, 1995) that can be used to characterize groundwater. In addition, resources included on the U.S. Environmental Protection Agency (USEPA; www.clu-in.org), Interstate Technology and Regulatory Council (ITRC; www.itrcweb.org), and ASTM International (ASTM; www.astm.org) websites may be useful.

4.2 DATA NEEDED TO SUPPORT MODELING EFFORTS

Fate and transport modeling is often used during the characterization phase for the purpose of evaluating the movement of cVOCs in the vadose zone, assessing the potential for cVOC migration to groundwater, developing soil cleanup goals for protection of groundwater, and estimating the potential risk posed by vapor intrusion into indoor air. Therefore, in addition to delineating concentrations of cVOCs in various environmental media (Section 4.1), site characterization should include sampling for site-specific soil properties to support these modeling efforts. For example, a site-specific screening analysis of the risk posed by the vapor intrusion pathway may require information regarding site stratigraphy and building parameters in addition to the following soil properties: bulk density, grain density, total porosity, grain size distribution, moisture content, fraction of organic carbon, and air permeability (DTSC, 2005a; revision pending). Other fate and transport models may require additional site-specific parameters, such as hydraulic conductivity, estimated recharge or infiltration rates, biodegradation rates, and chemical retardation factors. The input parameter requirements for the models anticipated for use at a site should be considered during workplan development.

4.3 DATA NEEDED TO SUPPORT DESIGN OF PT&R ALTERNATIVES

Under the PT&R approach, an objective of the characterization phase is to collect data needed to support the design process. Sufficient data should be collected to eliminate or minimize the need for additional field mobilizations during the site-specific remedy evaluation or design phases.

4.3.1 Excavation/Disposal

Data needed for design of the excavation can be collected with other site investigation activities. As applicable to a given site, the following data is necessary to adequately address the excavation limits and design:

- vertical and horizontal distribution of contaminants (i.e., areal extent of impacted soil and soil gas, depth of impact) and volume of soils to be excavated;
- identification of soil conditions that affect the selection of excavation equipment;
- depth to groundwater;
- climatology/seasonal variations (e.g., months with higher likelihood of rainfall events or higher groundwater table);
- survey map of site features (e.g., topography, existing structures, utilities, wells, surface water control measures, property boundaries);
- geotechnical data for each soil type (i.e., soil classification, Atterberg limits, moisture content, bulk density);
- structural contour map of the top of competent bedrock; and
- waste characterization (to support identification of applicable disposal options).

4.3.2 Soil Vapor Extraction

The data collected should be sufficient to identify the feasibility of SVE, to design a pilot-scale test (if needed), and to begin designing the SVE system. At a minimum, the following data should be collected in conjunction with the site characterization activities:

- depth and areal extent of cVOC impacts in the vadose zone;
- types and concentrations of cVOCs;
- nature and location of co-located contaminants that may affect SVE performance or selected treatment;
- depth to groundwater;
- soil moisture conditions;
- stratigraphy of the impacted zone (e.g., homogeneous sand, interbedded sands and silts);

- soil types and properties (e.g., structure, grain size distribution, air permeability, moisture content, organic carbon content); and
- survey map of site features (e.g., topography, existing structures, utilities, pavement), if applicable.

4.4 ADDITIONAL CHARACTERIZATION REFERENCES

The reader is referred to resources available on the DTSC, ITRC, USEPA, and ASTM websites, including the following references:

- *Preliminary Endangerment Assessment Guidance Manual* (DTSC, 1994);
- *Data Quality Objectives Decision Error Feasibility Trials Software (DEFT)-Users Guide, EPA QA/G-4D* (USEPA, 2001a);
- *Guidance on Choosing a Sampling Design for Environmental Data Collection, for Use in Developing a Quality Assurance Project Plan, EPA QA/G-5S* (USEPA, 2002a);
- *Guidance on Systematic Planning Using the Data Quality Objective Process, EPA QA/G-4* (USEPA, 2006a);
- *Data Quality Assessment: A Reviewer's Guide, EPA QA/G-9R* (USEPA, 2006b);
- *Systematic Planning: A Case Study for Hazardous Waste Site Investigations (QA/CS-1)* (USEPA, 2006c);
- *Data Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S* (USEPA, 2006d); and
- *Vapor Intrusion Pathway: A Practical Guideline* (ITRC, 2007).

5.0 RISK ASSESSMENT

Evaluation of potential risks to human health and the environment posed by contaminants at a site is part of the site characterization process and supports the risk management decision-making process to determine whether additional site investigation, further risk assessment, and/or remediation may be necessary. Depending on when a site begins using the PT&R approach, some risk assessment elements may have already been conducted and therefore do not need to be repeated.

Risk assessments range from simple screening assessments to site-specific, comprehensive risk assessments. A human health risk assessment should be conducted to characterize the potential cancer risks and noncancer health hazards posed by chemicals of concern (COCs) identified during site characterization (Section 5.2). A scoping-level ecological risk assessment should be conducted to determine whether further assessment of potential ecological impacts is necessary (Section 5.1). Cleanup goals and risk management considerations are addressed in Chapter 6.

5.1 ECOLOGICAL RISK ASSESSMENT

A scoping-level ecological investigation should be conducted to characterize the chemical, physical, and biological aspects of a site and to evaluate the potential for complete exposure pathways between ecological receptors and COCs (DTSC, 1996ab; USEPA 1997b). If the results of this qualitative assessment indicate further assessment is necessary (e.g., Phase I predictive assessment), then the PT&R process is not applicable to the site. Even if no currently-complete exposure pathways for ecological receptors are identified, the biological characterization of the site may become an important consideration for risk management decisions. For example, removal actions to protect human health may adversely impact ecological receptors or critical portions of their habitat.

5.2 HUMAN HEALTH RISK ASSESSMENT

For cVOCs in soil, vapor intrusion into indoor air is typically the most significant exposure pathway, and usually poses a greater risk from long-term (chronic) exposure than other exposure pathways. This section focuses on the soil vapor intrusion pathway, but also addresses evaluation of other exposure pathways for cVOCs in soil and groundwater.

Multiple lines of evidence should be used for evaluation of vapor intrusion into indoor air and associated health risks (ITRC, 2007). Typically, active soil gas samples are collected in the early stages of an exposure evaluation. Other lines of evidence include sampling data for passive soil gas samples, soil matrix, groundwater, sub-slab soil gas, and indoor air. Some or all of these lines of evidence are used in site characterization for defining the source location and nature and extent of cVOC contamination. Soil matrix data are also used for evaluating risks associated with direct contact exposure pathways for cVOCs in soil (Section 5.2.5). Measured and/or predicted groundwater COCs and concentrations are used to evaluate potential groundwater risks.

A screening level health risk assessment may be sufficient, depending on factors such as the complexity of the site, the degree of characterization of site contamination, and the anticipated remedy. Complex sites (such as those with multiple contaminants, impacts to multiple environmental media, and/or complex features) may require a site-specific comprehensive risk assessment subsequent to, or in lieu of, a screening risk assessment.

General guidance for conducting a site-specific comprehensive risk assessment is provided in *Risk Assessment Guidance for Superfund: Volume I--Human Health Evaluation Manual, Part A, Baseline Risk Assessment* (USEPA, 1989). Additional guidance for conducting risk assessments is available at the following agency websites:

- USEPA: http://www.epa.gov/oswer/riskassessment/risk_superfund.htm
- DTSC: http://www.dtsc.ca.gov/AssessingRisk/index.cfm.

The risk assessment process includes:

- identification of COCs and affected environmental media;
- identification of exposure pathways, land use, and potential human receptors;
- determination of exposure point concentrations;
- selection of toxicity criteria; and
- calculation and characterization of potential cancer risks and noncancer hazards.

5.2.1 Chemicals of Concern

All VOCs (both chlorinated and non-chlorinated) detected at the site should be included as COCs for risk assessment. In addition to detected VOCs, potential transformation products and other contaminants suspected to be present based on the CSM should be discussed and evaluated for potential inclusion in the quantitative risk assessment. Examples of transformation products include 1,2-dichloroethene and vinyl chloride from tetrachloroethene (PCE) and trichloroethene (TCE). High concentrations of primary contaminants in soil or soil gas might elevate analytical detection limits and preclude detection of other cVOCs. Further investigation and refined sampling and analytical methods may be needed to address these uncertainties.

5.2.2 Exposure Pathways and Land Use Scenarios

All potential exposure pathways and receptors identified in the CSM for current and potential future uses of the property should be described in the risk assessment. The land use and risk assessment exposure scenarios evaluated for this guidance are (1) residential and (2) industrial or commercial. Evaluation of off-site receptors or exposure scenarios other than default residential and industrial/commercial scenarios for the baseline risk assessment requires site-specific adjustment to the PT&R approach and additional consultation with the DTSC.

Exposure to VOCs in shallow soil can occur by several pathways, including inhalation of VOCs that have migrated from the subsurface into indoor air, inhalation of outdoor air, direct contact with soil (incidental ingestion and dermal contact), and ingestion of food products contaminated with cVOCs from soil or groundwater. Because vapor intrusion into indoor air of buildings is the most significant exposure pathway of concern for cVOCs at most sites, the vapor intrusion pathway is often the primary focus of risk assessments. However, other factors, such as the nature and extent of contamination or the current or potential land uses at a site, may warrant evaluation of risks associated with direct soil exposure pathways. DTSC should be consulted regarding evaluation of soil exposure pathways for sites with cVOC contamination.

Exposure to cVOCs that have migrated from vadose zone soil to groundwater, or are predicted by model simulations to reach groundwater (see Section 4.2), should be evaluated. Exposure pathways for cVOCs in groundwater include, but are not limited to, ingestion, dermal contact during showering/bathing, and inhalation of vapors released indoors from household use of groundwater. DTSC should be consulted regarding groundwater exposure pathways for sites with cVOC contamination.

5.2.3 Exposure Point Concentration

The approach used for estimating exposure point concentration at a given site depends on the matrix sampled, spatial and temporal scale of samples, spatial and temporal differences in COC concentrations, and land use.

Soil Gas. The maximum detected concentration of each COC in soil gas should be used as the exposure point concentration for the vapor intrusion risk assessment (DTSC, 2005a; Cal/EPA, 2005b). DTSC approval is required for use of any other metric for the exposure point concentration. Alternatively, point estimates of risk might be calculated using concentrations of COCs for each sampling location. Point estimates of risk are useful for spatial evaluation of contamination and risk at sites with multiple contaminants, and can be useful for evaluating remedial alternatives. For soil gas samples in which a site COC was not detected because of elevated detection limits (Section 5.2.1), the detection limit for the COC should be used as a proxy concentration (DTSC, 2005a). The distribution and extent of contamination at the site and the possible existence of localized areas of higher concentrations (i.e., hot spots) must be considered in both risk assessment and risk management.

Soil Matrix. For sites with high concentrations of cVOCs, soil matrix data can be used to identify locations with cVOC concentrations exceeding saturation limits for the soil and provide concentration data for soil exposure assessments. For sites at which the soil saturation limit for a cVOC is exceeded, the evaluation of vapor intrusion risk requires additional consultation with DTSC. Maximum detected concentrations of cVOCs in shallow soil matrix samples should be used for screening-level soil risk assessments (DTSC, 1994; and updates). In consultation with DTSC, the estimated average concentration (95 percent upper confidence limit of the arithmetic mean) may be used at sites with sufficient characterization of cVOCs in soil matrix.

Groundwater. Exposure point concentrations for cVOCs in groundwater should be based on concentration data collected from monitoring wells over a period of time that allows assessment of temporal trends. For sites at which cVOCs have not yet reached groundwater, concentrations predicted by modeling can be used to support risk estimates (see Section 4.2). A combination of monitoring data and modeling might be appropriate for estimating exposure point concentrations at some sites. The maximum measured or model-predicted concentration of cVOCs in groundwater should be used. DTSC approval is required for use of other metrics for the exposure point concentration.

The data quality objectives (DQOs) for data used to support the exposure point concentration for groundwater will depend on the exposure pathways being evaluated (e.g., vapor intrusion, drinking water). For example, evaluation of vapor intrusion focuses on concentrations at the water table (DTSC 2005a).

Both groundwater and soil gas data should be used to develop the exposure point concentration for the vapor intrusion pathway. Data from both media should be used to estimate the indoor air exposure concentration and the higher predicted exposure concentration should then be used for assessing vapor intrusion risks (DTSC, 2005a).

5.2.4 Health Risk Assessment for Vapor Intrusion into Indoor Air

The *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* (Vapor Intrusion Guidance; DTSC 2005a, revision pending) should be followed for conducting preliminary and/or site-specific screening evaluation of risks associated with VOCs. The Vapor Intrusion Guidance provides default attenuation factors for estimating indoor air concentrations from soil vapor concentrations for use in preliminary screening risk assessments and also describes procedures for estimating site-specific soil vapor attenuation factors and predicting indoor air VOC concentrations and risks. Current USEPA vapor intrusion guidance is provided in *Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (USEPA, 2002b). The most current toxicity criteria available from Cal/EPA and USEPA should be used. Cumulative cancer risks and noncancer hazards should be calculated for sites with multiple VOCs.

Although soil gas data are preferred for evaluation of vapor intrusion, preliminary risk screening with groundwater monitoring data might be conducted in limited cases. When groundwater data is used, the Vapor Intrusion Guidance should be followed and the vapor intrusion risk associated with both soil gas and groundwater should be evaluated. Soil sampling might be necessary at some sites, such as those with high concentrations of VOCs and/or where site conditions preclude soil gas sampling (see Section 4.1). In consultation with DTSC, an approach can be developed for evaluation of the soil vapor intrusion into indoor air pathway.

5.2.5 Health Risk Assessment for Exposures to cVOCs in Soil

In addition to soil vapor intrusion into indoor air, evaluation of risks associated with exposures to cVOCs in soil matrix may be warranted at sites with high concentrations of

cVOCs in shallow soil (0 to 15 feet below ground surface). Emissions of cVOCs into outdoor air may be significant. DTSC should be consulted regarding evaluation of exposures to cVOCs in soil and application of DTSC guidance. Generally, the DTSC *Preliminary Endangerment Assessment Guidance Manual* (PEA Manual; DTSC, 1994; and updates) and updated exposure factors provided in *DTSC Human Health Risk Assessment Note 1: Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Military Facilities* (HHRA Note 1; DTSC 2005b) should be followed.

5.2.6 Health Risk Assessment for Exposures to cVOCs in Groundwater

The PEA Manual (DTSC, 1994; and updates) and updated exposure factors provided in HHRA Note 1 (DTSC, 2005b) should be used for assessment of risks associated with exposure to cVOCs in groundwater.

5.2.7 Human Health Screening Levels

Human health screening levels are risk-based concentrations of chemicals in specific environmental media. Risk-based concentrations (also referred to as health-based concentrations) are developed using a target cancer risk or noncancer hazard quotient. The calculations rely on multiple assumptions and factors for estimating contaminant environmental fate and transport and receptor exposures for a hypothetical (or specific) site. Generally, conservative default exposure assumptions are used to derive these screening levels. For carcinogens, risk-based concentrations are developed for both cancer risk and noncancer hazard, and the lesser (more protective) concentration is selected as the screening level.

Screening levels based on default assumptions can be used for screening risk assessments. Site-specific risk-based concentrations may also be developed. Screening-level and/or site-specific risk-based concentrations are used in development of RAOs and cleanup goals (Chapter 6).

For screening risk assessments, cancer risk and hazard are estimated by dividing the maximum concentration of each COC by the corresponding medium-specific screening level (see Sections 5.2.7.1, 5.2.7.2, and 5.2.7.3). The ratio of the exposure point concentration to the risk-based concentration is multiplied by the target risk or hazard quotient from which the risk-based concentration was calculated (10^{-6} risk and hazard quotient of 1 for screening assessments). When using risk-based screening levels for assessing risks, both cancer risk and hazard must be evaluated for carcinogenic COCs, and cumulative risk and hazard for multiple COCs and exposure pathways must be presented. For the vapor intrusion into indoor air pathway, the maximum detected concentration of each COC in soil gas is compared with the corresponding screening level for soil gas.

Risk-based concentrations for the residential scenario should be used for screening risk assessments. In addition to the residential scenario, risk assessments for industrial, commercial, and other land use scenarios might be conducted for the evaluation of

remedies and the risk management decision process. Sites with individual chemical or cumulative cancer risks greater than 1 x 10^{-6} or noncancer hazards (hazard index) greater than 1 for the residential scenario should be considered for further risk management evaluation (see Chapter 6).

5.2.7.1 Screening Assessment for cVOCs in Soil Gas

The Vapor Intrusion Guidance (DTSC, 2005a, revision pending) should be used to develop risk-based screening levels for cVOCs in soil gas. Default soil gas attenuation factors provided in the Vapor Intrusion Guidance can be used to develop generic risk-based screening levels. Alternatively, the USEPA spreadsheet version of the Johnson and Ettinger model for vapor intrusion into indoor air and certain assumptions for building properties provided in the Vapor Intrusion Guidance can be used with data for site-specific soil properties to derive soil gas attenuation factors and screening levels. For sites or areas for which soil matrix samples are necessary in addition to soil gas data, Appendix E of the Vapor Intrusion Guidance provides procedures for using soil matrix data to estimate soil gas concentrations and discusses the limitations and uncertainties in using soil matrix data.

5.2.7.2 California Human Health Screening Levels

California Human Health Screening Levels (CHHSLs) are based on standard exposure assumptions and chemical toxicity values published by Cal/EPA and the USEPA, and can be used for evaluation of cVOCs in soil gas (Cal/EPA, 2005ab). The CHHSLs for cVOCs are risk-based concentrations for soil gas for the vapor intrusion/indoor air exposure pathway only. Soil gas CHHSLs were developed using the USEPA spreadsheet version of the Johnson and Ettinger model for soil vapor intrusion into indoor air.

The CHHSLs might not be adequately protective for estimating impacts to indoor air in structures with: basements; significant openings to the subsurface; preferential pathways for vapors (such as utility openings); or substandard ventilation systems. Sites with conditions significantly different from those assumed for the CHHSLs warrant a site-specific evaluation using the Vapor Intrusion Guidance (DTSC, 2005a; revision pending).

Toxicity criteria used for the CHHSLs should be reviewed prior to use and updated (i.e., adjust the screening level) as necessary. The current list of CHHSLs can be found at http://www.oehha.ca.gov/soil.html. The guidance document on use of CHHSLs for screening risk assessments (Cal/EPA, 2005b) should be consulted.

5.2.7.3 Soil Screening Levels for Soil Matrix

Risk-based screening levels for contact exposure pathways for COCs in soil can be developed using the PEA Manual (DTSC, 1994; and updates) and current exposure parameter values recommended in HHRA Note 1 (DTSC, 2005b). As applicable,

CHHSLs for non-VOCs present at the site may be used for soil exposure pathways in the screening risk assessment.

USEPA Regional Screening Levels (RSLs) for soil matrix may be used for screening evaluation of soil exposure pathway risks for COCs (ingestion, dermal contact, inhalation of outdoor air). DTSC guidance on use of RSLs (DTSC, 2009bc), including adjustments for Cal/EPA toxicity criteria, should be followed. As with other screening levels, both cancer risk and hazard must be evaluated for carcinogenic COCs, and cumulative risk and hazard for multiple COCs must be estimated. The RSLs do not include the vapor intrusion pathway, and therefore should be used in conjunction with one of the aforementioned vapor intrusion assessments.

5.2.7.4 Screening Levels for cVOCs in Groundwater

The Vapor Intrusion Guidance (DTSC, 2005a, revision pending) should be used to develop risk-based screening levels for cVOCs in groundwater for the vapor intrusion pathway (Sections 5.2.4 and 5.2.7.1). A partitioning model is used to estimate groundwater concentrations from the risk-based soil vapor concentrations.

For exposures to groundwater via pathways other than vapor intrusion (ingestion, dermal contact from bathing, inhalation of vapors emitted into indoor air from household use of groundwater), the PEA Manual (DTSC, 1994; and updates) and updated exposure factors provided in HHRA Note 1 (DTSC 2005b) should be used for development of risk-based concentrations of cVOCs in groundwater.

USEPA RSLs for tap water may be used for screening evaluation of groundwater exposure pathway risks for COCs (ingestion, inhalation of vapors emitted into indoor air from household use of groundwater). DTSC guidance on use of RSLs (DTSC, 2009bc), including adjustments for Cal/EPA toxicity criteria, should be followed. As with other screening levels, both cancer risk and hazard must be evaluated for carcinogenic COCs, and cumulative risk and hazard for multiple COCs must be estimated. The RSLs for tap water do not include dermal exposure or the groundwater vapor intrusion pathway, and therefore they should be used in conjunction with one of the aforementioned assessments.

6.0 CLEANUP GOALS

The findings of the risk assessment (Chapter 5) can be used, along with consideration of site-specific characteristics, to guide establishment of RAOs and associated cleanup goals. This chapter discusses cleanup goals for the protection of human health and groundwater (Sections 6.1 and 6.2, respectively), risk management considerations (Section 6.3), short-term risks during remediation (Section 6.4), and assessment of risk posed by residual cVOC concentrations (Section 6.5).

6.1 Cleanup Goals for Protection of Human Health

Factors that are considered in the development and selection of risk-based cleanup goals include the health impact endpoint (cancer risk and/or noncancer hazard), the intended use of the property (e.g., residential, industrial/commercial), exposure pathways, and the number of COCs. Remedy selection at some sites may have to address multiple exposure pathways. Methods and scenarios for evaluation of human health risks and development of risk-based concentrations are described in Section 5.2, and include exposures by vapor intrusion into indoor air and exposures to COCs in soil and groundwater.

As a starting point for development of risk-based cleanup goals, an initial cleanup goal of 1×10^{-6} should be calculated for each carcinogenic COC. For noncancer hazard, the risk-based cleanup goal for each COC should be less than or equal to a cumulative hazard index of 1. When a site has multiple COCs that contribute significantly to calculated excess total risk or hazard, the risk-based cleanup goal for each COC may need to be adjusted to a lower concentration to reduce the overall cumulative risk and/or hazard to an acceptable range. Another option is to use point estimates of cumulative risk for spatial evaluation of risk, as indicated in Section 5.2.3. Risk management decisions that would allow cleanup goals with greater risks or hazards may be made on a site-by-site basis (Section 6.3).

Residential and industrial/commercial land use scenarios are considered under the PT&R approach. Recommended exposure assumptions may be found in the Vapor Intrusion Guidance (DTSC, 2005a; revision pending), HHRA Note 1 (DTSC, 2005b), or the documentation for CHHSLs (Cal/EPA, 2005ab). HHRA Note 1 includes default exposure assumptions for a construction scenario. Other land use and exposure scenarios (such as maintenance worker or park visitor scenarios) require use of site-specific exposure factors.

Human health screening levels such as CHHSLs (Section 5.2.7.2) may be considered as risk-based cleanup goals to streamline the remedy selection process. Soil gas screening levels for cVOCs are based on a single pathway of exposure—inhalation of soil vapors migrating from the subsurface into indoor air. For most sites, soil gas screening levels are adequately protective for soil exposure pathways. For sites at which soil gas samples are not feasible, DTSC should be consulted for development of indoor air risk-based concentrations for soil matrix and/or groundwater, or for an alternate approach.

6.2 Soil Cleanup Goals for Protection of Groundwater

If the PT&R approach is being implemented to decrease or eliminate an on-going threat to groundwater posed by cVOCs in vadose zone soil, the process of establishing cleanup goals should also consider soil and soil gas concentrations necessary to protect water resources. Cleanup goals protective of groundwater are established based on site-specific considerations and applicable policies, statutes, and regulations. Potentially applicable policies, statutes, and regulations include:

- State and federal statues and regulations;
- California State Water Resources Control Board (SWRCB) and California Regional Water Quality Control Board (RWQCB) policies;
- water quality control plans adopted by the SWRCB and RWQCB; and
- relevant standards, criteria, and advisories adopted by State and federal agencies.

DTSC has not identified a single methodology that can be used to establish soil cleanup goals for protection of groundwater. Examples of methods that could be used to establish cleanup goals include use of unsaturated zone fate and transport modeling (Section 4.2) and "lookup" tables of screening levels (e.g., USEPA RSLs for Soil for Protection of Groundwater). The method used for a given site should be selected in consultation with, and with the approval of, the regulatory agencies overseeing the site cleanup.

6.3 RISK MANAGEMENT

The final cleanup goal and remediation strategy is a risk management decision based on numerous factors. The risk-based point of departure for risk management decisions is 1×10^{-6} for cancer risk and a hazard index of 1 for noncancer risk. Sites with individual chemical risk or cumulative risk from multiple COCs in excess of these points of departure may require remediation. In general, risks that are less than 1×10^{-6} are called *de minimus* and are not considered to require regulatory intervention. The range of risk (excess cancer risk posed by a site) that is considered as potentially acceptable for risk management decisions starts at 1×10^{-6} (one in a million) and goes up to 1×10^{-4} (one in ten thousand).

Development of RAOs and final cleanup goals at a site involves consideration of the:

- nature and magnitude of human health risks and uncertainties,
- current and future land use,
- risk-based cleanup goals and other criteria or requirements (including the RAOs),
- potential impact to ecological receptors and/or their habitat,
- technical and economic feasibility,
- regulatory criteria, and
- community concerns.

Many factors are considered in the final risk management decisions and the acceptable risk for a project may be greater than the point of departure. Evaluation of each remedial alternative for the site should include an estimate of the reduction in risk and a determination of risk management measures needed for contamination remaining in excess of risk-based concentrations (see Sections 6.5, 8.5.1, and 9.3.8). Risk management decisions (including mitigation and control of potential exposure) and technical supporting information are presented in remedy selection documents (see Section 7.2).

6.4 SHORT-TERM RISKS DURING REMEDIATION

Short-term risks associated with implementation of a remedy should be considered during evaluation of remedial alternatives. For many sites, a qualitative evaluation of risks associated with implementation of remedial alternatives is sufficient, but other sites will require a more quantitative evaluation (USEPA, 1991ab). Releases of cVOCs from soil during cleanup activities might pose significant risks to people who live or work in the vicinity of the site and to workers who are involved in the site cleanup. Evaluation and selection of remedial alternatives should identify and consider measures to monitor and control short-term exposure and risks. This evaluation should include consultation with local agencies (e.g., air quality management district). Site safety plans should be developed. Implementation of certain remedies might require perimeter monitoring of vapors (see Sections 8.2.2 and 9.3.3). Community concerns associated with short-term risks are addressed through the public participation process (see Section 3.1.3).

6.5 POST-CLEANUP EVALUATION

Following the completion of the remedial action, a post-cleanup risk evaluation may be required when residual cVOC concentrations remain, as indicated by confirmation sampling results. Risks can be estimated using the same procedures as those used for the pre-remediation baseline risk assessment or another approach (such as site-specific risk assessment or screening risk assessment as summarized in Section 5.2).

Confirmation sampling approaches for soil excavations and SVE systems are discussed in Sections 8.5.1 and 9.3.8, respectively. Additional information for confirmation sampling associated with the PT&R alternatives is provided in Appendices C and E.

7.0 EVALUATION OF CLEANUP TECHNOLOGIES FOR CHLORINATED VOCs IN VADOSE ZONE SOIL

In a conventional cleanup process, if the results of the risk screening process indicate that a cleanup action is warranted, the next step is an evaluation of the technologies appropriate for remediation of cVOCs in soil. This chapter provides the administrative record, technical basis, and evaluation necessary for streamlining the cleanup alternative evaluation. This chapter also addresses the site-specific evaluation and remedy selection process for cleanup of cVOC contaminated soils. Much of the streamlining is achieved by the DTSC study summarized in Section 7.1. The streamlined approach for evaluating remedial alternatives can be documented by:

- including pertinent sections of this PT&R guidance in the administrative record[1] and
- including a discussion regarding the use of the PT&R approach for the cleanup alternative selection in the decision document.

7.1 TECHNICAL BASIS FOR PT&R GUIDANCE FOR SITES WITH CHLORINATED VOC CONTAMINATION IN VADOSE ZONE SOIL

DTSC conducted a study of sites where the primary COCs included cVOCs in vadose zone soil and for which DTSC provided oversight of the cleanup process. The objective was to identify the technologies that were consistently evaluated as potential remedies and to identify the remedies that were subsequently selected at a site. The study, equivalent to the screening and evaluations conducted under a FS or CMS, included the following activities:

- review of literature relevant to sites with cVOC contamination (see Appendix B for a summary of the technologies reviewed and applicable at sites with cVOCs in unsaturated soil);
- identification of a representative number of DTSC sites with cVOC contaminated soils;
- review of the decision documents to determine which cleanup alternatives were routinely either screened out or selected for the remedy; and
- identification of the rationale for selection of the remedy.

DTSC reviewed its EnviroStor database to identify sites with vadose zone soils impacted with cVOCs. The database evaluation identified 90 sites for which remedy selection or implementation had occurred as of June 2009. These cleanup decisions occurred as either an interim removal action or as a final remedy. Table 3 summarizes the types of sites included in the DTSC study.

[1] Alternatively, include the PT&R guidance as an electronic appendix to cleanup alternative evaluation document.

Table 3. Cleanup Options Selected to Address Chlorinated VOCs in Vadose Zone Soil for the Sites Evaluated by DTSC Study

DTSC Site Type (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Corrective Action (16[2])	1	14	0	6	0	0
Military Facilities (19[2])	3	12	0	6	2	0
Schools (3)	0	1	0	2	0	0
State Response/ NPL[3] (33[2])	7	19	0	17	4	1
Voluntary Cleanup (19[2])	4	11	2	13	0	0

Notes:
[1] IC is institutional control. Usually used in conjunction with another cleanup option.
[2] Some sites in this category selected multiple cleanup options (i.e., this number is not simply the sum of values listed in this row).
[3] National Priorities List

The DTSC study compiled data about the site characteristics, including site activities, types of contaminants present, other affected media, and depth to groundwater. Notably, most of the sites reviewed had cVOC impacts to both vadose zone soil and groundwater and therefore had separate remedial alternatives for groundwater. The most frequently encountered contaminants included TCE, PCE, metals, and fuel-related compounds. Appendix B provides additional details regarding the characteristics of sites included in the DTSC study.

DTSC reviewed the cleanup alternative decision documents for the sites identified in the database review. The review focused on the cleanup alternatives that were considered and the factors that led to the selected cleanup alternative. DTSC evaluated three variables in detail:

- frequency of selection of the cleanup alternatives (Table 3);
- rationale for selection of the cleanup alternatives (described below); and
- rationale for rejection of the cleanup alternatives considered by the selection process (Table 4, Appendix B).

Based on this review, SVE and excavation/disposal were identified as the proven technologies for sites with cVOCs in vadose zone soil.

Table 4. Cleanup Options Considered for Chlorinated VOCs in Vadose Zone Soil for the Sites Evaluated by DTSC Study

Technology	No. of Site Alternatives Analyses Considering Technology	No. of Site Alternatives Analyses Rejecting Technology	Primary Reasons for Rejection During Cleanup Alternative Analysis[1]						
			Overall Protection	Compliance with ARARs[3]	Reduction of Toxicity, Mobility, Volume	Long-term Effectiveness	Short-term Effectiveness	Cost	Implementability
No Action	90	90	88	3	0	2	0	0	0
ICs[2] Only	34	32	29	2	1	2	0	0	0
Excavation/ Disposal	59	15	0	0	0	1	3	12	10
Soil Vapor Extraction	66	11	0	1	2	6	0	4	4
In Situ Treatment	17	15	1	0	1	10	0	6	10
Containment	20	13	6	2	4	3	0	1	1
Ex Situ Treatment	14	13	1	0	0	5	2	8	9

Notes:
1 National Contingency Plan (NCP) criteria
2 Institutional controls
3 Applicable or relevant and appropriate requirements

Review of the cleanup alternative decision documents indicates that SVE was the most frequently selected cleanup alternative for cVOCs in vadose zone soil. For many sites, the rationale for use of SVE as an interim removal action, or as a final cleanup alternative, was based on USEPA's designation of SVE as the primary presumptive remedy in *Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with VOCs in Soils* (USEPA, 1993b). Additional rationale for selecting SVE included the ability to remove cVOC mass at depths greater than could be achieved by excavation/disposal, particularly where cVOCs in the vadose zone posed an on-going threat to groundwater. SVE was less likely to be chosen for sites with shallow groundwater, shallow VOC impacts, or where multiple contaminant groups were present.

Excavation/disposal was the next most frequently selected cleanup alternative for cVOCs in soil. This technology was often selected based on its demonstrated effectiveness in addressing shallow soil impacts or source areas and its ability to provide timely remediation of the site. Based on the sites reviewed, the alternative was selected for impacted soil volumes ranging from about 20 to 30,000 cubic yards and for sites with first groundwater encountered at depths less than about 20 feet bgs. When not selected, excavation/disposal was typically rejected based on cost or ability to implement at a given site.

Seventeen sites included in the DTSC study evaluated one or more *in situ* treatment technologies to address cVOCs in vadose zone soil. Of these sites, only two sites selected an *in situ* treatment technology. One site selected reductive dechlorination to remediate a cVOC source near the capillary fringe; SVE was selected as a contingent remedy. The other site selected a combination of SVE and *in situ* chemical reduction to address both cVOCs and hexavalent chromium. *In situ* treatment approaches were most often rejected based on concerns regarding the ability to effectively treat the cVOCs, unproven effectiveness of some treatment techniques, ability to control resulting impacts to groundwater, and implementability.

Twenty sites included in the DTSC study evaluated containment by capping as a remedial technology for soil impacts. The rationale for selecting containment as part of the cleanup approach was based on the ability to provide sufficient protection and the ability to implement with the current or planned land use. This technology was most frequently rejected based on the inability to reduce or sufficiently control the cVOC contamination, an incompatibility with the current or planned land use, and the requirement for long-term stewardship.

Fourteen sites included in the DTSC study evaluated *ex situ* treatment. All but one site rejected *ex situ* treatment primarily based on cost and implementability considerations. *Ex situ* treatment was selected at one site because the approach was determined to be feasible based on the volume of impacted soil (greater than 200,000 cubic yards) and the ability to reuse the treated soil on-site.

7.2 FOCUSED EVALUATION AND SELECTION OF CLEANUP ALTERNATIVE

Under State and federal law, an analysis of alternatives is required for sites undergoing remediation. Following an initial evaluation, a more detailed and focused evaluation that considers the site characteristics must be conducted on the PT&R alternatives. Because the cleanup alternative screening evaluation presented in Section 6.1 and Appendix B was conducted in accordance with the initial screening requirements of a FS and CMS, it may be used in lieu of a site-specific initial screening evaluation for sites undergoing the streamlined PT&R approach, provided that the use of the PT&R screening evaluation is cited in the administrative record.

The next step in the PT&R approach is to determine whether excavation/disposal or SVE is the most appropriate cleanup alternative. The alternatives evaluation may consist of a site-specific evaluation of the no action, excavation/disposal, and/or SVE alternatives. Focusing on these PT&R alternatives is consistent with the National Contingency Plan (NCP) when:

- the number of alternatives evaluated for a site are reasonable;
- the number of alternatives evaluated are based on the scope, characteristics, and complexity of the site; and
- detailed analyses need only be conducted on a limited number of alternatives that represent viable approaches to the cleanup.

Application of the PT&R approach in this guidance does not preclude consideration of additional cleanup alternatives if determined to be appropriate for a site. However, use of the PT&R approach would still reduce the burden associated with screening and evaluating those additional cleanup technologies being considered.

As illustrated in Figure 3, both alternatives have the potential to allow unrestricted use of the site. However, operation of a SVE system has a longer duration and typically necessitates a regulatory oversight agreement. The focused alternatives evaluation may be prepared under State or federal guidelines, as summarized in Table 5.

In addition to using the DTSC initial alternatives evaluation (Section 7.1), the following site-specific elements of the remedial alternative evaluation process should be addressed in the appropriate remedy selection document:

- identification of applicable federal/State/local requirements (known as applicable or relevant and appropriate requirements (ARARs) under some cleanup processes);
- establishment of site-specific RAOs; and
- evaluation of the PT&R alternatives and the no action alternative against the applicable NCP criteria[2]:

[2] Only the effectiveness, implementability, and cost criteria apply to the DTSC RAW process. For hazardous waste sites, the RCRA-balancing criteria can be used instead of the NCP criteria.

Threshold Criteria
1) overall protection of human health and the environment,
2) compliance with federal/State/local requirements,

Balancing Criteria
3) long-term effectiveness and permanence,
4) reduction of toxicity, mobility or volume through treatment,
5) short-term effectiveness,
6) implementability based on technical and administrative feasibility,
7) cost,

Modifying Criteria
8) State and local agency acceptance,
9) community acceptance.

Additional criteria may also be considered in the remedial alternative evaluation process for a given site. For example, an evaluation of the sustainability of each remedial alternative could be used to identify potential environmental stressors (e.g., resource depletion, physical disturbances) and their associated impacts. The *Interim Advisory for Green Remediation* (DTSC, 2009d) provides additional discussion regarding sustainability as a criterion in the remedy selection process.

Figure 3. Summary of PT&R Cleanup Alternatives

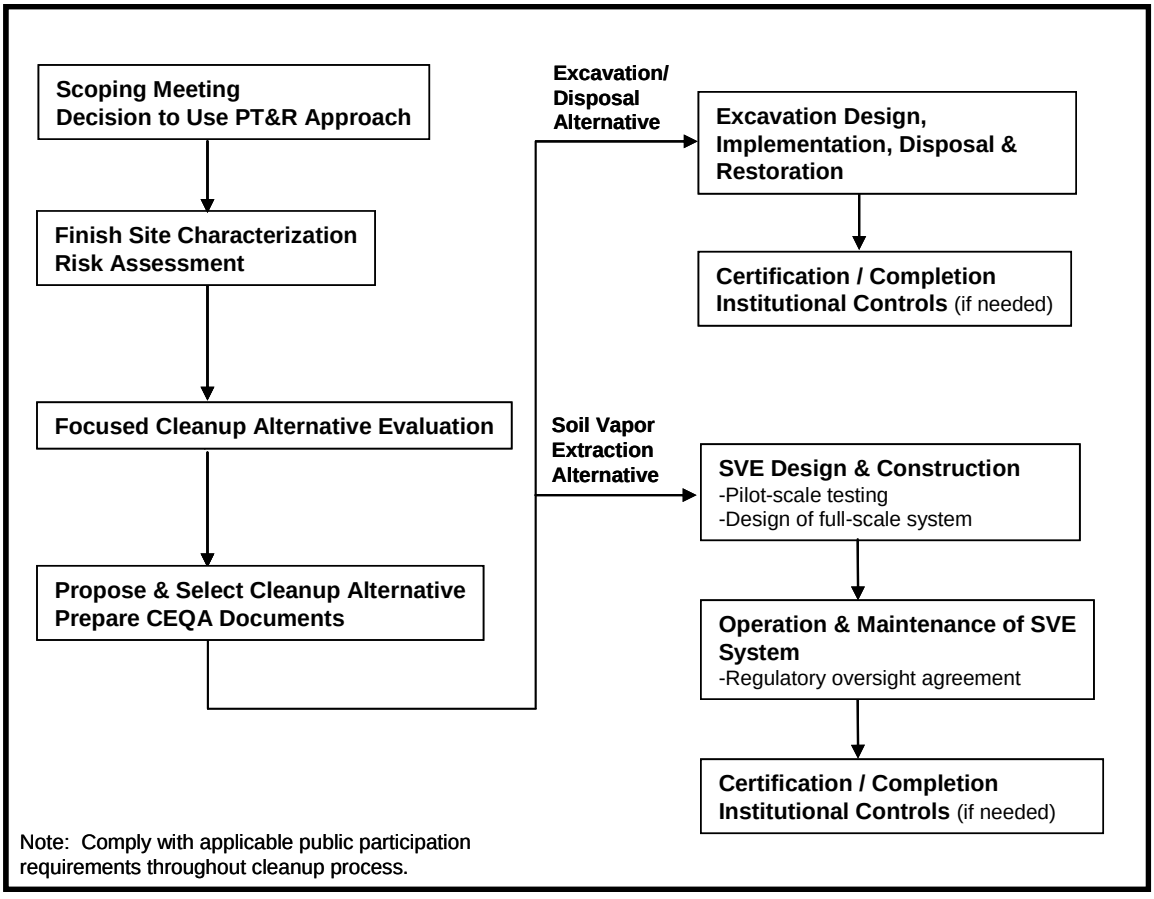


Table 5. State and Federal Guidelines for Focused Alternatives Evaluation

Law	Process	Description	Reference(s)
HSAA	Remedial Action Plan (RAP)[1]	Process for developing, screening, and detailed evaluation of alternative remedial actions for sites. Response action selection document under HSC §25356.1.	DTSC, 1995
	Removal Action Workplan (RAW) [1, 2]	Prepared when a proposed, non-emergency removal action or a remedial action is projected to cost less than $2,000,000. Response action selection document under HSC §25356.1.	DTSC, 1993, 1998
CERCLA	Feasibility Study (FS)	Process for the development, screening, and detailed evaluation of alternative remedial actions for sites.	USEPA, 1988, 1999
	Engineering Evaluation/ Cost Analysis (EE/CA)	Analogous to, but more streamlined than, the FS. Identifies the objectives of the removal action and analyzes the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives.	USEPA, 1993a
RCRA or HWCL	Corrective Measures Study (CMS)[1]	Mechanism used by the corrective action process to identify, develop, and evaluate potential remedial alternatives.	USEPA, 1991c, 1994, 1997c
HSAA, HWCL, RCRA, CERCLA	Interim Measures[1] or Interim Actions	Actions to control and/or eliminate releases of hazardous waste and/or hazardous constituents from a facility prior to the implementation of a final corrective measure or remedy.	

Notes:
1 See Appendix D for link to example or sample documents.
2 A feasibility study is not required for RAW process. However, the RAW should evaluate effectiveness, implementability, and cost of various removal alternatives.
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
HSAA – Hazardous Substance Account Act
HWCL – Hazardous Waste Control Law
RCRA – Resource Conservation and Recovery Act

Regardless of the process used to evaluate and select the cleanup alternative for a site, the alternatives evaluation report generally should:

- discuss and present documentation showing that the PT&R approach is appropriate;
- identify and provide the rationale for the preferred alternative for the site;

- document the site-specific RAOs, regulatory requirements, and the detailed alternatives analysis;
- include preliminary design information for final remedy implementation; and
- discuss how the PT&R approach will be integrated with any groundwater remedial measures or vapor intrusion mitigation measures.

Necessary CEQA documents are usually prepared concurrently with remedy selection documents, if not sooner (see Section 7.4 for further discussion of CEQA requirements). Once approved by DTSC, the draft remedy selection and CEQA documents are circulated for public comment (DTSC, 2003).

The administrative record for the site should, among other things, include the following elements:

- copy of pertinent sections of this PT&R guidance (alternatively, include the PT&R guidance as an electronic appendix to cleanup alternative evaluation document); and
- responses to any comments pertaining to the decision to use the PT&R approach.

7.3 DESIGN AND IMPLEMENTATION OF SELECTED CLEANUP ALTERNATIVE

The operational and technical plans for implementing the selected cleanup alternative should be prepared and submitted to DTSC, either in the remedy selection document (if appropriate) or as separate submittals. Examples of operational plans include the health and safety plan, transportation plans, and confirmation sampling plan. The technical plans contain the specific engineering design details of the proposed cleanup approach, including designs for any long-term structures (e.g., SVE system). As applicable, the design plans should include the design criteria, process diagrams, and final plans and specifications for the structures as well as a description of any equipment to be used to excavate, handle, and transport contaminated soil. Field sampling and analysis plans that address sampling during implementation and confirmation sampling to assess achievement of the RAOs should also be prepared.

Chapters 8 and 9 provide further discussion of the design and implementation for the PT&R alternatives.

7.4 CALIFORNIA ENVIRONMENTAL QUALITY ACT

Remediation of cVOC contamination must meet all applicable local, State and federal requirements, including CEQA. CEQA (Pub. Resources Code, sec. 21000 et seq.) requires public agencies carrying out or approving a project to conduct an environmental analysis to determine if project impacts could have a significant effect on the environment. Public agencies must eliminate or reduce the significant environmental impacts of their decisions whenever it is feasible to do so.

All proposed projects for which the DTSC has discretionary decision-making authority are subject to CEQA if they potentially impact the environment. Examples of approval actions which require CEQA review and documentation include: RAPs, interim measures, RAWs, and corrective actions. For further information, DTSC's CEQA-related polices and procedures are available at www.dtsc.ca.gov.

8.0 DESIGN AND IMPLEMENTATION OF EXCAVATION / DISPOSAL ALTERNATIVE

This chapter describes the approach to be used to remove contaminated soil exceeding site cleanup goals for cVOCs (and other co-located contaminants, if identified). Please recognize that this chapter is intended as guidance. All elements discussed may not be applicable to a given site.

8.1 EXCAVATION, DISPOSAL, AND RESTORATION PLAN

A workplan should be prepared which identifies the logistical procedures and site activities associated with excavation, disposal and site restoration. The actual title of this plan will depend on the cleanup process applied to the site. For example, DTSC's Removal Action Workplan (RAW) process incorporates the required plan elements. DTSC's Remedial Action Plan (RAP) and corrective action processes often require preparation of a separate plan. However, additional streamlining under the PT&R approach could be achieved if the plan is included with another document (e.g., as an appendix to the RAP). For the purposes of this chapter, the workplan is referred to as the "excavation, disposal, and restoration plan" (EDRP). Appendix D provides a link to an EDRP sample and annotated outlines for supporting documents.

Major topics and elements of the EDRP include the following:

- site background
- nature and extent of contamination
- clean-up goals
- objectives and scope of plan
- project organization and schedule
- description of the technical basis for the approach (e.g., why excavation/disposal was selected as the cleanup alternative; estimated extent of excavation, estimated volume of soil to be excavated)
- pre-excavation activities;
- excavation activities
- dust control and air monitoring
- waste management
- backfill and site restoration activities
- quality assurance and quality control (QA/QC)
- health and safety monitoring
- reporting

The EDRP should be supported by the following documents, as applicable, which can be submitted separately or as appendices to the plan:

- site-specific health and safety plan (HASP)
- storm water pollution prevention plan (SWPPP)
- community air monitoring plan
- confirmation sampling plan (see Section 8.5.1, Appendix E)
- public participation plan (see Appendix D)
- stockpile sampling plan
- transportation plan (see Appendix D)

8.2 PRE- EXCAVATION ACTIVITIES

Prior to conducting fieldwork, a series of project management and regulatory tasks should be completed. The general areas that require preparatory activities include:

- site access
- permits
- location of underground utilities
- health and safety
- waste management
- scheduling of staff and equipment resources
- coordination with laboratory for analysis and assessment
- arrangements for sample management
- coordination with off-site disposal facility
- notifications (e.g., agencies, public)

Local jurisdictions, such as municipal public works departments and air districts, often require excavation or grading permits. Depending on the volume of soil to be excavated or disturbed, the RWQCB may specify waste discharge requirements, preparation of a SWPPP, and/or a National Pollution Discharge Elimination System (NPDES) permit. The key elements of the permit application specific to the location of the excavation should be identified. Some municipalities have restrictions on the type of equipment that can be used within a specified distance from water mains, sewer lines, and utility lines. In addition, air districts may require a similar application that identifies the mitigation measures to reduce or eliminate air dispersal of contaminants.

8.2.1 Dust Control and Air Monitoring

The EDRP should discuss the actions (specified in the remedy selection document) that will be implemented to control fugitive dust and cVOC emissions during implementation of the remedy. Dust control is required during construction, demolition, excavation, temporary containment, soil loading for transportation, and other earthmoving activities, including, but not limited to, land clearing, grubbing, scraping, travel on site, and travel on access roads to and from the site.

Most air districts and/or County environmental health departments have recommended or required dust mitigation measures and/or engineering controls. Applicable air pollution regulations, monitoring requirements, performance criteria, and acceptable

control strategies should be cited and described. The following items are generally considered:

- wind breaks and barriers, or ceasing work when wind speeds are above a certain level;
- frequent water applications;
- application of soil additives;
- control of vehicle access;
- vehicle speed restrictions;
- covering of piles;
- use of gravel and rumble strips at site exit points to remove caked-on dirt from tires and tracks;
- decontamination and tracking pad to thoroughly wash and decontaminate vehicles before leaving the site;
- wet sweeping of public thoroughfares; and
- cause for work stoppage.

8.2.2 Work Zone and Community Air Monitoring

Dust mitigation measures and/or engineering controls, implemented in conjunction with real-time and time-weighted average dust monitoring, are intended to ensure that dust generated during project activities will not have an adverse impact on site workers, the environment, or the community.

In addition to dust mitigation measures, most air districts and/or County environmental health departments set action levels to control the emission of cVOCs from excavating, grading, and handling (storage and loading) activities. These activities can produce significant volatilization of cVOCs from contaminated soil into the local atmosphere. Air monitoring for cVOC concentrations should be conducted within the exclusion/ decontamination zone for site worker safety, and outside of the soil removal and decontamination/exclusions zones (fence-line monitoring) to ensure that potential exposure of sensitive off-site receptors to site contaminants will not have any adverse effects. Exclusion-zone monitoring of cVOCs for site worker safety is further discussed in Section 8.7, Health and Safety Monitoring.

Community air monitoring (outside of the site fence-line) should be considered for activities occurring near residential communities, schools, and other sensitive receptors (e.g., elderly or high use community areas) to ensure that the implementation of the remedy does not pose a potential threat to off-site receptors. Site-specific risk-based action levels should be calculated, in consultation with DTSC, and included in the design.

8.3 EXCAVATION ACTIVITIES

8.3.1 Cal-OSHA Standards for Trenching and Excavations

The EDRP should address the applicable California Division of Occupational Safety and Health (Cal-OSHA) safety requirements for excavations (Cal. Code Regs., tit. 8, §1540, §1541, §1541.1). These requirements state that workers exposed to potential cave-ins must be protected by shoring, sloping, or benching the sides of the excavation, or placing a shield between the side of the excavation and the work area. These safety standards also provide for protection of the stability of adjacent structures. Any excavation four feet or deeper must have adequate means of access/egress every 25 feet of lateral travel from workers. Excavations greater than four feet deep require testing for hazardous atmospheres and protection from hazards associated with water accumulation. Entry into some excavations/ trenches may require a Cal-OSHA permit and compliance with Cal-OSHA regulations for trenching and excavation.

8.3.2 Surface Water Control Measures

If there is the potential for rainfall during the excavation activities, the EDRP should address surface water runoff, erosion control, and sediment control measures. These measures should conform to State and local requirements and should provide for segregation of surface water runoff from impacted and non-impacted areas.

8.4 WASTE MANAGEMENT

8.4.1 Management and Profiling of Excavated Soil

Excavated soil should be managed in accordance with applicable State and federal requirements, and as recommended in *Management of Remediation Wastes Under RCRA* (USEPA, 1998). Excavated soil may be hauled directly off site for disposal (provided arrangements have been made with a disposal facility) or may be stockpiled on site for further profiling. The EDRP should describe the measures that will be used to control emissions during soil handling and the measures that will be used to minimize mixing of soil containing higher COC concentrations with less impacted soils. A schematic or scaled map of the areas to be excavated and the locations where soil will be stockpiled should be included. Excavated soil should be segregated and stockpiled based on the existing site data. Stockpiles are typically segregated according to the disposal options (see Table 6).

Table 6. Disposal Alternatives for Excavated Soil Under the PT&R Approach

LEVEL OF CONTAMINATION	DISPOSAL ALTERNATIVES
Concentrations below acceptable risk levels	Can be used to backfill the original excavation
Impacted at levels above acceptable risk levels but below hazardous levels (nonhazardous solid waste)	Off-site disposal at Class I, Class II, or Class III landfill (depending on their waste acceptance criteria)
RCRA hazardous waste or California-only hazardous waste	Treatment to meet land disposal restrictions may be required before off-site disposal at Class I landfill. See text for further discussion.

Temporary stockpiles should be managed as identified in the EDRP. The plan should comply with the applicable requirements of the California Code of Regulations, title 22, division 4.5 and stockpiling requirements for remediation waste staging found in Health and Safety Code Section 25123.3(b)(4)(B). The EDRP should designate the locations for placement of stockpiles, address measures to prevent migration and/or dispersal of the soil (e.g., liners, covers), describe the measures that will be used to control emissions, and identify the appropriate distance from the upper edge of any excavation. Representative samples should be collected and analyzed from the stockpiles to verify that the soil has been appropriately segregated and categorized.

If identified as a RCRA listed or characteristic waste or a California-only hazardous waste, contaminated soil that is excavated must be managed and disposed as such. Off-site management for RCRA hazardous wastes must be disposed in a landfill authorized to accept RCRA hazardous waste and must meet any applicable land disposal restrictions (LDRs). If the excavated soil exceeds specified LDR concentrations, the hazardous wastes must be treated to meet specific LDRs limits prior to land disposal. In addition, if the soil is a RCRA characteristic waste, all other underlying hazardous constituents found in the soil must meet their associated LDRs prior to disposal. Refer to *Management of Remediation Wastes Under RCRA* (USEPA, 1998) for optional LDR treatment standards for contaminated soils (typically ten times the concentration levels for a generated waste). If the excavated soil is below specified LDR concentrations, the soils do not need to be treated prior to land disposal and can be disposed of appropriately at a Class I landfill. Soil identified as California only hazardous waste is disposed of in a Class I landfill.

The sampling results from the soil stockpiles must be included in the waste profile form for the landfill operators to review and determine if the profile meets its acceptance criteria. Upon acceptance by a landfill, the stockpiled soil is loaded into the transport container (e.g., truck, rail car, bin) and transported to the landfill with appropriate documentation (e.g., under a hazardous waste manifest and LDR notification/ certifications for a Class I landfill, under a bill of lading for a Class II landfill).

8.4.2 Loading and Transportation

Soil transported for offsite management or disposal must be transported in accordance with applicable State and federal laws. Loading of transport containers should be adjacent to stockpiles or excavations, just outside designated exclusion zones. Any soil falling to the ground surface during loading should be placed back into the container. Loaded containers should be inspected to ensure that they are within acceptable weight limits and should be covered and inspected prior to departure to minimize the loss of materials in transit. The waste profile analyses should accompany the shipping document (i.e., bill of lading or hazardous waste manifest) to the offsite facility. Appendix D provides a link to an annotated outline for a transportation plan.

8.5 BACKFILL AND RESTORATION

Backfill operations can begin once the RAOs have been achieved, as demonstrated through confirmation sampling. Excavated areas should be restored to be consistent with future use and graded to ensure proper runoff.

8.5.1 Confirmation Sampling

Confirmation samples are collected to determine if the RAOs have been achieved and thus whether the removal action is completed. The scope of confirmation sampling activities is a function of the site-specific RAOs, the media to be sampled, and potential land re-use scenarios (e.g., residential, industrial). Appendix E provides further discussion of confirmation sampling for soil excavations.

Confirmation sampling activities should be conducted in accordance with an approved confirmation sampling plan (see Appendix E for annotated outline). Depending on site-specific circumstances and/or the site cleanup process, the confirmation sampling plan can be included as an appendix to a document (e.g., EDRP), incorporated into a document (e.g., RAW), or prepared as a standalone document. The plan and sampling activities should be prepared and implemented in accordance with standard geologic and engineering principles and practices using appropriately licensed and experienced professionals.

8.5.2 Borrow Source Evaluation

Borrow source evaluation should address the physical and chemical characteristics of the soil. Backfill soils should have physical properties consistent with engineering requirements for the planned site use. For example, the International Building Code typically requires a compaction between 90 and 95 percent. When selecting material for backfilling excavated areas, steps should be taken to minimize the chance of introducing soil to the site that may pose a risk to human health and the environment. As a general rule, fill should not be obtained from industrial areas, from sites undergoing environmental cleanups, or from commercial sites with potential impacts (e.g., former service stations, dry cleaners).

The *DTSC Information Advisory, Clean Imported Fill* (DTSC, 2001) suggests that two approaches can be used to demonstrate acceptable backfill materials: (1) providing appropriate documentation and conducting analyses as needed; or (2) collecting samples from the borrow area or borrow area stockpile and analyzing the samples for an appropriate list of parameters.

The selected analytes should be based on the source of the fill and knowledge of the prior land use. Table 7 summarizes potential contaminants based on the fill source area.

Table 7. Potential Contaminants Based on Land Use in Fill Source Area

FILL SOURCE AREA	POTENTIAL TARGET COMPOUNDS
Land near an existing freeway	metals, PAHs
Land near a mining area or rock quarry	metals, asbestos, pH
Agricultural land	pesticides, herbicides, metals
Residential or commercial land	VOCs, SVOCs, TPH, PCBs, metals, asbestos

From *DTSC Information Advisory, Clean Imported Fill* (DTSC, 2001)

A standard laboratory data package, including the QA/QC sample results, should accompany all analytical reports. Contaminants detected in the fill material should be evaluated for risk in accordance with the *Preliminary Endangerment Assessment Guidance Manual* (DTSC, 1994) or the methods described in Chapter 5. If contaminant concentrations exceeding acceptance criteria are identified in the soil, the fill should be deemed unacceptable and new fill material should be obtained, sampled, and analyzed.

Fill documentation should include detailed information on the previous land use(s) in the area from which the fill is taken, the findings of any environmental site assessments, and the results of any testing. If the documentation is inadequate, samples of the fill material should be collected and analyzed for an appropriate list of parameters. This may be the best alternative when large volumes of fill material are anticipated or when larger areas are considered as borrow areas.

If limited fill documentation is available, samples should be collected from the potential borrow area and analyzed for an appropriate list of parameters. If fill material is not characterized at the borrow area, it will need to be stockpiled until analyses have been completed. Table 8 provides recommended sampling frequencies for the fill soil. In general, approximately one sample should be collected and analyzed per truckload. This sampling frequency may be modified upon consultation with appropriate regulatory agencies if all fill material is derived from a common borrow area.

Composite or incremental sampling for fill characterization may or may not be appropriate, depending on the quality and homogeneity of the source/borrow area and

the potential contaminants. The *DTSC Information Advisory, Clean Imported Fill* (DTSC, 2001) provides further discussion on the use of composite samples for certain contaminant groups.

Table 8. Recommended Fill Material Sampling

EXTENT OF INDIVIDUAL BORROW AREA	NUMBER OF SAMPLES[1]
2 acres or less	Minimum of 4 samples
2 to 4 acres	Minimum of 1 sample for every 0.5 acres
4 to 10 acres	Minimum of 8 samples
Greater than 10 acres	Minimum of 8 locations with 4 subsamples per location
VOLUME OF BORROW AREA STOCKPILE	**NO. OF SAMPLES**
Up to 1,000 cubic yards	1 sample per 250 cubic yards
1,000 to 5,000 cubic yards	4 samples for first 1,000 cubic yards; 1 sample per each additional 500 cubic yards
Greater than 5,000 cubic yards	12 samples for first 5,000 cubic yards; 1 sample per each additional 1,000 cubic yards.

Notes:

1 The number of samples needed to characterize fill material is a site-specific decision.
From *DTSC Information Advisory, Clean Imported Fill* (DTSC, 2001)

8.6 QUALITY CONTROL / QUALITY ASSURANCE

The EDRP should address QA/QC procedures that will be followed during the excavation activities. For example, the EDRP should address field oversight and reporting, field documentation, and confirmation sampling. If a QAPP was prepared during the characterization phase, the plan may be amended to address the pertinent changes for the EDRP.

8.7 HEALTH AND SAFETY MONITORING

The HASP addressing site-specific excavation, restoration, and the health and safety issues should be included or referenced in the EDRP. The health and safety requirements should apply to all personnel, including contractors and subcontractors conducting work at the site. The HASP used during site characterization activities may be amended to include excavation and restoration activities. The HASP should be prepared in accordance with the requirements of California Code of Regulations, title 8, section 5192 and all applicable federal, State and local laws, ordinances, and regulations and guidelines.

The HASP should at a minimum address the following:

- identification of activities being carried out, the associated risks, and the measures in place to prevent injury;
- names and titles of personnel in charge;
- emergency action plan;
- location of HASP (a copy should be on site at all times);
- on-site safety awareness training for all personnel for all field activities identified (e.g. tail gate meetings and frequency);
- identification of hazards (job hazard analysis) and requirements for documentation and correction of hazards;
- air monitoring requirements to identify and measure site contaminant concentrations generated during the soil removal and decontamination activities and guide the selection of personal protective equipment;
- appropriate personal protective equipment and safety systems for each site activity identified; and
- assurance that all workers comply with the rules to maintain a safe work environment (e.g., disciplinary methods for workers who fail to comply).

8.8 COMPLETION REPORT

The EDRP should briefly identify the key elements that will be covered in a work completion report[3] (completion report) along with the anticipated date of submittal. The completion report should be prepared in conformance with standard geologic and engineering principles and practices using appropriately licensed and experienced professionals. A link to an annotated outline for the completion report is provided in Appendix D. At a minimum, the report should provide the following:

- summary of the work performed;
- any difficulties or unexpected conditions encountered;
- deviations from the approved workplan;
- the results of post-excavation sampling (i.e., before backfilling and restoration) and compliance with performance standards;
- determination as to whether the RAOs were met;
- results of the post-excavation evaluation for cVOCs (if applicable, see Section 6.5);
- written and tabular summary of disposal activities;
- as-constructed drawings and results of post-restoration activities, if applicable;
- health and safety activities including any analytical results;
- compliance with all permit requirements;
- copies of permits for the project; and
- copies of signed manifests and bills of lading.

[3] The title of this document will vary depending on the cleanup process.

9.0 DESIGN AND IMPLEMENTATION OF SOIL VAPOR EXTRACTION ALTERNATIVE

For sites that have selected SVE as an interim response action or as part of the remedy, this chapter describes the approach that could be used to design and implement SVE systems for the remediation of cVOCs in a manner that achieves site-specific RAOs. The intent is to enhance the efficiency, but not replace, site-specific decisions made on the basis of individual site characteristics, applicable laws and regulations, and the principles of good engineering design. Appendix C supplements this chapter by providing additional considerations and resources for the design and implementation of SVE systems. Please recognize that this chapter and Appendix C are intended as guidance. All elements discussed may not be applicable to a given site.

The content of this chapter is largely based on, and specifically recommends the use of, the U.S. Army Corps of Engineers (USACE) *Engineering and Design - Soil Vapor Extraction and Bioventing, EM-1110-1-4001* (USACE Manual; USACE, 2002). Please note that the USACE Manual has been developed for all nature of sites and therefore addresses multiple technical issues that are not relevant to the PT&R approach for cVOCs.

This chapter may be used as a checklist of actions that may be required in the implementation of SVE systems. Applicable sections of the USACE Manual should be referenced for details. In addition, useful reference materials relating to SVE may be obtained from the USEPA or the Air Force Center for Engineering and the Environment (AFCEE) websites (www.clu-in.org; www.afcee.af.mil).

9.1 SITE CHARACTERISTICS FAVORABLE FOR EFFECTIVE SVE SYSTEMS

As discussed in Section 3.2, certain site conditions favor effective application of SVE for cleanup of cVOCs in vadose zone soils, including:

- relatively homogeneous, permeable soils
- relatively low moisture content soils
- adequate vadose zone thickness
- relatively small capillary fringe thickness
- cVOCs located above capillary fringe
- low soil organic carbon content
- volatile contaminants

9.2 GENERAL CONSIDERATONS FOR SVE IMPLEMENTATION

9.2.1 Remedial Action Objectives

SVE systems can be operated to achieve a variety of RAOs, including the following common examples:

- removing as much cVOC mass as feasible prior to application of other remedial technologies

- removing cVOC mass to decrease cVOC emissions during a subsequent soil excavation
- removing cVOC mass posing an on-going threat to groundwater
- controlling vapor flow / mass removal around a building having a potential vapor intrusion risk
- achieving health risk-based cleanup goals

The range in potential RAOs results in differences in the performance metrics that are used to evaluate the success of the SVE system and to determine when it is appropriate to shutdown the system. For some RAOs, the performance metric could be based on the estimated mass remaining in the subsurface and/or a mass removal rate. For other RAOs, the performance metric could be based on demonstrating achievement of numerical risk-based cleanup goals.

9.2.2 Transitioning from Interim Removal Action to Final Remedy

To provide near term reduction of cVOC mass posing a risk to human health, the environment, and/or groundwater, SVE is often implemented as an interim removal action (also referred to as an interim measure under some cleanup processes) taken prior to selection and implementation of the final remedy. The SVE system may or may not be included as part of the final remedy. For example, SVE may be excluded from the final remedy if site-specific RAOs are achieved during the interim removal action or if SVE proves ineffective for site conditions. For sites requiring on-going remediation of cVOCs in the vadose zone, SVE can be included in the alternatives analysis for the final remedy (see Section 7.2) and, if appropriate, selected as the final remedy.

9.2.3 Coordination with Groundwater Remedy

As illustrated by the DTSC study discussed in Section 7.1, cVOC releases commonly generate both soil vapor and groundwater plumes. Depending on site conditions, the soil vapor and groundwater plumes have the potential to interact during the cleanup action. Offgasing of cVOCs from groundwater can act as an on-going source of cVOCs to the vadose zone. Likewise, a vapor plume can continue to contribute cVOC mass to groundwater. The PT&R approach should be coordinated with the groundwater remedy so that cVOCs in groundwater do not recontaminate vadose zone soils and vice versa.

The SVE system may not be effective in removing contamination near the capillary fringe or water table because the higher moisture content decreases air permeability and inhibits cVOC mass removal. Where a significant mass of cVOCs occurs in the capillary fringe or near the water table, additional remedial measures that target this zone may be needed and/or the contamination may need to be addressed by the groundwater remedy.

9.2.4 Vapor Intrusion

SVE systems may be implemented to reduce or alleviate vapor intrusion into buildings. However, it is important to recognize that advective transport of cVOC vapors by SVE system operation potentially could direct cVOC vapors toward or beneath occupied buildings, and possibly affect the indoor air quality which might otherwise be unaffected. These potential effects should be considered during the system startup and in the operation and maintenance (O&M) plan. Permanent shallow soil vapor monitoring points adjacent to the buildings and/or beneath building foundations may be needed to assess the potential for the SVE system to affect indoor air quality.

The design and operation of the SVE system should be coordinated with vapor intrusion mitigation systems in nearby buildings (DTSC, 2009a). Consideration should be given to potential conflicting needs, infrastructure needs, and project schedules as well as the potential for SVE system operation to affect the performance of these vapor intrusion mitigation systems.

9.2.5 Licensure Requirements

SVE systems should be designed, built, installed, operated, and maintained in conformance with standard geologic, engineering, and construction principles and practices using appropriately licensed and experienced professionals.

9.3 SVE IMPLEMENTATION ELEMENTS

This section briefly describes the major elements of the SVE system design and implementation process. The section subheadings are generally consistent with headings in the USACE Manual which should facilitate finding the topic in the USACE Manual for further details.

9.3.1 Characterization and Technology Screening

The primary criteria in selecting SVE technology options are air permeability of the porous medium and volatility of the contaminants. Principal data needs include:

- nature and extent of contamination
- CSM
- soil matrix properties
- air permeability
- organic carbon content
- moisture content
- depth to groundwater
- thickness of capillary fringe

Other considerations are site conditions that may affect the SVE system design or performance (such as building locations, utilities, infrastructure, pavement, accessibility, etc.). Additional considerations for technology screening include cost, implementation, and regulatory constraints and objectives.

Because cVOCs are the main COC considered under the PT&R approach, the technology screening process focuses on the treatment options for the extracted soil vapors. Appendix C provides additional information regarding potential treatment options.

The qualitative and quantitative information obtained during site characterization (Section 4.2.2) and the evaluation of the applicability of the PT&R approach (Section 3.4) should be sufficient to determine whether it is appropriate to use SVE.

9.3.2 Pilot-Scale Testing for SVE System

Pilot-scale testing is performed as a means of gathering important design information and to determine field-scale air-flow behavior. This testing usually measures pressures, flow rates, contaminant concentrations, and other parameters during air pumping tests. Typically, the pilot-scale testing is conducted as a discrete activity with a specific pilot test workplan and pilot test report. However, on a case-by-case basis, DTSC may consider proposals to go directly to full-scale application (forgoing a discrete pilot-scale test phase) if:

- an adequate soil vapor monitoring network is constructed as part of the initial system design;
- the design plan includes provisions for future system modification based on operational data;
- the design plan includes a detailed strategy and procedures for system startup, testing, validation, and commissioning;
- a system validation and startup report (containing the information typically presented in a pilot-scale test report) is submitted after implementation of the system startup and proveout; and
- DTSC is consulted and concurs with the decision.

Basic activities during a pilot test (or equivalent system validation/startup testing) include:

- determine design data needs;
- develop testing strategy;
- prepare test plan (e.g., pilot-scale test workplan);
- test performance and data analysis; and
- prepare test report (e.g., pilot test report, system validation and startup report).

Considerations for pilot or system validation/startup testing include:

- documentation of operational vacuum parameters to define initial SVE system effectiveness;
- implementation of monitoring well infrastructure consisting of multi-depth, discrete interval monitoring wells

  - located at appropriate distances from extraction wells (e.g., wells located closer to and farther away from the expected zone of influence from the extraction well) and
  - discretely screened in both permeable and the most recalcitrant soils;
- construction of monitoring well infrastructure having dedicated polyvinyl chloride materials (typically two inch diameter) with appropriate screen intervals (typically a three foot minimum screen interval as opposed to tubing with a six inch screen); and
- construction and blower capacity to add wells to the SVE system should operational data indicate the need for additional extraction well capacity.

9.3.3 Design of Full-Scale SVE System

A full-scale SVE system should be designed to maximize the removal of cVOCs from the subsurface in the most efficient and timely manner. The following data should be collected, using appropriate DQOs, to support the design:

- speciated chemicals and total VOCs present in soil vapor
- properties of the target compounds in the soil vapor
- location of cVOCs in relation to the water table
- characteristics of soil in the zone of interest
- advective and diffusive rate-limiting factors in cVOC removal
- design airflow rate and flow path to remove the contaminants from the subsurface

The major components of the SVE design process include:

- SVE design strategy
- design basis (including SVE system objectives and performance metrics)
- well location (see Appendix C for recommendations regarding well placement)
- overall pneumatic considerations
- well construction
- piping, valves, and manifold system
- condensate control
- particulate filters
- blower silencers
- blowers and vacuum pumps
- instrumentation and process control
- electrical systems planning
- effluent treatment methods (see Appendix C for discussion of common methods),
- water and vapor condensate storage, treatment, and disposal methods (including secondary containment)
- SVE treatment system housing
- emissions monitoring / control
- local air permit requirements
- noise control

Some of these design components offer an opportunity to consider green remediation concepts. For additional discussion, see the *Interim Advisory for Green Remediation* (DTSC, 2009d).

9.3.4 SVE System Construction

SVE system construction entails installation of all SVE system infrastructure including vapor extraction wells, vapor monitoring wells, piping, controls, utilities, and treatment system components. The design plan should include a narrative description of the SVE system and should be supported by appropriate calculations, drawings, and figures. Refer to the USACE Manual for details of the following design elements:

- applicable USACE and USEPA design policy and requirements
- design document content (see also Section 9.4.3)
- system construction / construction oversight

Applicable permits (typically from the local air district) should be obtained prior to system construction and operation. A construction completion report should be submitted to DTSC documenting the full-scale SVE system (see Section 9.4.4).

9.3.5 System Startup and Commissioning

During the SVE system startup and commissioning phase, the SVE system is evaluated to determine whether the system has been constructed as designed, equipment is operating within specifications, and if any modifications are needed. In addition, initial performance data are collected and evaluated. Appendix C outlines considerations for initial optimization of the SVE system.

The major elements to be addressed by this phase include:

- collection of baseline vapor data in all extraction and monitoring wells prior to system startup;
- equipment shakedown and testing;
- if the pilot test phase is incorporated into the system validation/startup process, the data requirements identified in Section 9.3.2 should be collected;
- system start-up / full-scale optimization;
- basic monitoring protocols for the SVE system that can be carried forward into long-term operation of the system; and
- data evaluation.

The system startup and commissioning phase should be documented in a system startup and validation report (see Section 9.4.5).

The design plan should include an overall strategy for commissioning, shakedown, and start-up activities of the SVE system. A start-up plan (or procedure) should consider the design objectives and system complexity and should include:

- checklists for each component or parameter that will be tested;
- minimum number of hours that each system, operation, or parameter should be tested; and
- how each component or system should be tested (i.e., what measurements should be made).

At the end of the start-up phase, the entire SVE system should be operating normally according to specifications.

9.3.6 Operation, Maintenance, and Monitoring

An O&M plan should be developed for the SVE system. The plan should provide the O&M strategy, operational guidelines, monitoring strategy, and system modification and optimization considerations. The O&M plan should be as flexible as possible and should include contingencies for possible operational problems. The elements of an O&M plan include:

- O&M strategy
- system objectives and performance metrics
- monitoring (including DQOs for each type of monitoring activity)
- well maintenance
- SVE treatment system O&M considerations
- SVE treatment system operation schedule
- recordkeeping
- continued system evaluation to ensure achievement of RAOs
- optimization strategy for SVE system
- reporting requirements (e.g., status reports, notifications)

The O&M plan should address routine procedures for operation, maintenance, sampling, analysis, and system modification, as well as non-routine activities such as troubleshooting and shutdown. The design strategy, and the assumptions adopted in the design, should be included in the operational requirements of the system. In addition, the plan outlines the project needs, site considerations, and system design.

The O&M plan should include strategies and/or a decision process for optimizing or improving the performance of the treatment system. Examples of potential system optimization or performance improvement measures might include increasing the SVE well density, operating in a pulse mode (see Appendix C), operating only SVE wells that are removing significant cVOC mass, and measures to increase air flow in areas with the highest cVOC concentration. The O&M plan should also include criteria or a decision framework for initiating rebound assessment (see Section 9.3.7) and for permanent system shutdown (see Section 9.3.8).

The O&M plan should address the steps to be taken should performance assessments indicate that the SVE system is insufficient to achieve site-specific RAOs (such as when the design basis zone of capture was inadequate or when cVOC concentrations are persistently elevated after prolonged system operation). Inadequate performance assessments may warrant system modifications and/or re-design (including additional extraction well installation).

9.3.7 Rebound Assessment

Rebound assessment is conducted when cVOC concentrations measured in vapor monitoring wells and extraction well effluent (while the system is active) meet the RAOs, and mass removal has become negligible. At this point, the SVE unit is shut down for an appropriate timeframe (see next paragraph) to evaluate whether subsurface concentrations rebound or whether subsurface RAOs have been achieved.

The timeframe for rebound assessment is a site-specific determination. The assessment should be based on data collected over sufficient duration so that the measured soil gas concentrations represent a return to equilibrium conditions and thus are appropriate for determining whether the RAO is met. Some assessment timeframes exceed one year and therefore should be integrated into project plans, especially when contemplating redevelopment. For sites where the rebound assessment period is too long for the planned redevelopment schedule, one option is to reduce the amount of time to observe the rebound response by decreasing the spacing of the vapor monitoring wells.

If soil vapor concentrations indicate a need for further vadose zone remediation during the rebound evaluation period, vapor extraction wells that can influence such areas of the site or zones requiring additional cVOC removal are restarted. Extraction should continue until subsurface vapor concentrations approach RAOs. This cycle continues until: soil gas concentrations in all vapor monitoring wells and extraction well effluent remain below RAOs for an appropriate timeframe (see above); or it becomes apparent that RAOs cannot be attained through SVE, at which point the system could be evaluated for permanent shutdown (see Section 9.3.8).

Appendix C provides additional considerations for rebound assessment.

9.3.8 System Shutdown, Closure, and Cleanup Confirmation

The decision to permanently shutdown a SVE system should be based on data obtained from the treatment system influent as well as depth-specific soil gas data obtained horizontally and vertically throughout the baseline extent of the soil gas plume (i.e., the extent of the plume prior to initiation of the SVE system). The soil gas data can be collected from existing vapor wells and additional soil gas borings (if needed) to ensure adequate coverage of the baseline plume extent. Cleanup confirmation should be based on an appropriate number of sampling events, conducted over an appropriate timeframe (see discussion in Section 9.3.7), to demonstrate that residual cVOC concentrations are stable and achieve the RAOs. Appendix C provides additional discussion of system shutdown, closure, and cleanup confirmation.

The design plan or O&M plan should identify the data requirements and decision framework needed to determine whether the SVE treatment should be shutdown and site RAOs have been achieved. The main elements of SVE system shutdown and cleanup confirmation include:

- shutdown strategy;
- sampling and analysis;
- evaluation of results;
- long-term monitoring requirements;
- rebound assessment (see Section 9.3.7); and
- closure report.

9.4 SVE SYSTEM DOCUMENTS

This section describes various documents that may need to be submitted for DTSC review and approval during the process of evaluating, designing, implementing, and operating a SVE system. Some documents discussed in this section may not be needed for a given site. Documents in addition to those described in this section may also be needed. Each document should include title and signature pages (with appropriate signatures and stamps/licensure) and a table of contents. The documents should be prepared in conformance with standard geologic and engineering principles and practices using appropriately licensed and experienced professionals.

9.4.1 Pilot-Scale Test Workplan

A pilot-scale test workplan should be prepared that addresses the following elements:

- project description
- remedial technology description
- test objectives (including performance metrics)
- experimental design and procedures
- management and staffing
- equipment and materials
- sampling and analysis
- data management
- data analysis and interpretation
- health and safety
- waste management and regulatory compliance
- community relations and public participation strategy
- reporting
- schedule

Appendix C includes an annotated outline for a SVE system pilot-scale test workplan.

9.4.2 Pilot-Scale Test Report

A pilot-scale test report should be prepared that addresses the following elements:

- introduction
- background
- objectives (including performance metrics)
- equipment (including the experimental setup, vapor collection system, vapor treatment systems, and monitoring equipment)
- monitoring and data collection (chemical concentrations, temperature, pressure/vacuum, flow rate, etc.)
- departures from the workplan
- results and discussion of physical parameters (e.g., air permeability, vacuum/ pressure distribution, radius of effective air exchange, vacuum/flow rate correlation)
- results and discussion for chemical parameters (e.g., extracted soil vapor, residual soil, recovered condensate, chemical data quality, emissions)
- conclusions regarding overall effectiveness of SVE
- recommendations for further data collection
- appendices presenting the laboratory analysis reports, QA reports, field data sheets, and well installation and boring logs

Appendix C includes an annotated outline for a SVE system pilot-scale test report.

9.4.3 Full-Scale Design Document

A design document should be prepared for the full-scale SVE system. The timing and mechanism for submitting the design document is a site-specific decision. The design may be submitted to DTSC for review and approval as one document or as separate documents depending on project-specific considerations and process. Based upon project needs, submittal and approval of a "conceptual" plan may be necessary prior to submittal and approval of the final system engineering plans. The system design may require a phased approach (such as discrete pilot-scale testing, system validation, startup testing, and agency review) prior to final approval.

The design document should include the minimum content discussed in this section. Additional content may be required depending upon site-specific conditions and the subsurface cleanup objectives. For example, for sites choosing to forgo the discrete pilot test phase (see Section 9.3.2), the design document should include a detailed protocol for system startup and validation. The design document should also discuss other documents that may be required for its proper implementation.

- **Introduction.** Identify the project, the purpose of the document, and the regulatory-basis for the SVE system.

- **Project Background.** Provide an overview of the rationale for use of SVE, current and future land use considerations, COCs, and other general project considerations. If appropriate, this section should also indicate how the SVE system is integrated with other subsurface remediation and vapor intrusion mitigation efforts.

- **Site Conditions Summary.** Provide an overview of the CSM and other pertinent information along with references to other documents. This section may reference previous documents (e.g., current conditions report, summary reports) which contain more detailed discussion of site conditions. The CSM discussion should summarize the following:
  - site geology
  - previous sampling efforts
  - list of COCs and maximum detected soil gas concentrations
  - plume maps and cross sections
  - remediation efforts and RAOs
  - potential remediation treatment / degradation by-products
  - ambient air quality considerations
  - estimates of the degree of indoor air impacts (such as Johnson and Ettinger modeling results), if applicable

- **Cleanup Goals and Objectives.** Identify the performance metrics and contingency measures for the SVE system. Reference section(s) identifying how the goals and objectives will be monitored and tested. As applicable, identify general institutional control (IC) requirements and/or use restrictions (such as prohibited construction and restricted building modifications).

- **Design Basis.** Identify the design assumptions and criteria to be met by the SVE system.

- **Construction Methods.** Identify the construction methods to be used once the design has been approved, including:
  - construction specifications
  - minimum material specifications
  - installation procedures
  - construction QC procedures
  - post-installation testing procedures

- **Design Calculations and Drawings.** Include the design calculations and drawings for the SVE system, including the basis for the estimated zone of capture.

- **Conceptual Drawings.** Include conceptual drawings indicating building locations, prescribed building envelopes, streets, driveways, hard-scape areas, utility easements, well design and placement, and other infrastructure considerations.

- **Remediation Approach.** Provide a detailed description of the proposed remediation approach, including any phasing (tier approach) concepts (see Section 9.3.5). Also, provide the following information:

- technical basis for the design of the SVE system
- construction and implementation requirements
- any contingent systems which may be required
- component specifications and verification of ability to meet performance measures
- detailed testing procedures (including on-the-job instructions)
- system validation and startup strategy and procedures
- permit requirements from other agencies (such as a permit to construct and a permit to operate vapor treatment systems)
- SVE system shutdown and/or exit strategy
- reporting requirements
- applicable engineering drawings and system diagrams

- **Implementation Mechanisms.** Address the Land Use Covenant (LUC) requirements, deed restrictions, construction QA/QC, soil management , waste management, transportation, and emission control/monitoring.

- **Financial Responsibility.** Identify the applicable financial responsibility requirements.

- **Health and Safety Plan.** Include a worker HASP that addresses such topics as worker training requirements, protective gear, and monitoring procedures.

- **Operation and Maintenance Plan.** As an appendix or as a separate stand-alone document, include an O&M plan that details the O&M requirements, monitoring requirements, implementation mechanisms, and responsibilities for tasks and final obligations. See Section 9.3.6 for recommended O&M plan content.

Appendix C includes an annotated outline for a full-scale SVE design document.

9.4.4 Construction Completion Report

A completion report should be submitted to DTSC after the full-scale SVE system has been constructed. If applicable, the content of this report could be incorporated into a system validation and startup report (see Section 9.4.5). The report should include as-built drawings of system components, a brief account of field activities associated with system installation and startup, QA/QC data, and other appropriate content to document construction of the SVE system.

9.4.5 System Validation and Startup Report

A system validation and startup report should be submitted that, at a minimum, contains the following:

- introduction
- background
- objectives (including performance metrics)

- SVE system equipment description (layout, drawings, initial calculations, etc.)
- system startup summary (e.g., test results, well configuration, monitoring data, instrument and system settings, flow rates)
- system operations summary (e.g., permit changes, treatment system changeouts, blower operating parameters, O&M activities)
- monitoring and data collection (e.g., chemical concentrations, temperature, pressure/vacuum, flow rate)
- results and discussion of physical parameters (e.g., air permeability, vacuum/ pressure distribution, radius of effective air exchange, vacuum/flow rate correlation)
- results and discussion for chemical parameters (e.g., extracted soil vapor, residual soil, recovered condensate, chemical data quality, emissions)
- O&M reporting
- conclusions regarding overall effectiveness of SVE, including an interpretation of the zone of capture of the system
- recommendations for on-going system operations and data collection
- supporting appendices (e.g., laboratory analysis reports, QA reports, field data sheets, and well installation and boring logs)
- permit compliance on air emissions

Appendix C includes an annotated outline for a system validation and startup report.

9.4.6 Status Reports

Status reports summarizing the performance of the SVE system should be submitted to DTSC at a frequency identified in the O&M plan. Appendix C outlines suggested content for these reports.

9.5 COMPLETION REPORT

Once remediation has been completed and RAOs are achieved (see Section 9.3.8), a completion report should be prepared to verify and document the activities and results of the cleanup. The completion report should be prepared in conformance with standard geologic and engineering principles and practice using appropriately licensed and experienced professionals.

10.0 CERTIFICATION / COMPLETION

When the approved remedy for cVOCs in the vadose zone has been fully implemented, DTSC will confirm through review of performance metrics (including confirmation sampling) that the RAOs have been achieved. The possible determinations are:

- the RAOs have been achieved for cVOCs;
- the response action has been fully implemented, is operating successfully, and on-going O&M is needed until the RAOs are achieved; and/or
- additional cleanup is necessary.

Based on the findings, DTSC will issue a certification letter, a completion letter, or a letter requiring additional work to address cVOCs in the vadose zone.

10.1 SITE CERTIFICATION

When DTSC determines that the approved remedy has been fully implemented, DTSC certifies the satisfactory completion of remedial action activities at the site.

- When DTSC determines that the approved remedy has been fully implemented and the remediation for cVOCs in the vadose zone results in a site restored to unrestricted residential standards, DTSC certifies that the required remedy has been completed and that no further remediation is necessary, unless new information is obtained. The site status on DTSC's EnviroStor database is changed from "Active" to "Certified".
- If the site has been remediated to standards appropriate for restricted use of the property, DTSC issues a certification letter that the site soil has been restored to levels agreed upon in the regulatory decision document. The certification letter is issued after any requirements for a LUC and/or O&M agreement and O&M plan are met. The site status on DTSC's EnviroStor database is changed from "Active" to "Certified/Operation and Maintenance".
- If the approved remedy includes actions requiring operation, maintenance, and monitoring (e.g., SVE systems), DTSC certifies that the remedy has been implemented once: (1) sufficient information has been submitted to verify that the remedy has been implemented and is functioning as proposed in the remedy selection document and in design plans; and (2) any LUC, O&M agreement, and O&M plan requirements have been met. The DTSC certification letter will describe the remedy implemented and will state that DTSC has continuous oversight and the responsible party is required to operate and maintain the measures necessary for on-going protection of public health and the environment. The Site status on DTSC's EnviroStor database is changed from "Active" to "Certified/Operation and Maintenance".

10.2 COMPLETION LETTER FOR INTERIM ACTIONS / INTERIM MEASURES

Removal actions may be implemented as interim actions or interim measures taken to begin the cleanup process while the final remedy is being evaluated and selected. Examples of this include actions taken to reduce the mass of cVOCs in the vadose zone, or actions taken to address cVOCs in the vadose zone while remedies for groundwater are being evaluated. For these cases, the site is not ready for certification following the implementation of these actions. Hence, DTSC will issue a completion letter acknowledging that the PT&R removal action has been implemented and that additional actions are required to address cVOCs at the site.

10.3 ADDITIONAL ACTIONS NEEDED

Achievement of the RAOs outlined in the remedy decision document may not be possible. For these cases, DTSC will issue a letter acknowledging that the removal action was implemented, noting that the RAOs were not achieved, and requiring that the remaining contamination should be addressed through a subsequent response action.

11.0 LONG-TERM STEWARDSHIP

Long-term stewardship applies to sites and properties where long-term management of contaminated environmental media is necessary to protect human health and the environment over time. This includes sites where remediation may take place over several years and sites where contaminated media will remain in place for a much longer period of time. This chapter discusses elements that may be required to meet the needs of long-term stewardship. The elements included in below may not apply to all sites based on site-specific conditions and remedial timeframes.

11.1 INSTITUTIONAL CONTROLS FOR CONTAMINATION REMAINING IN PLACE

ICs are used to stop or reduce the exposure of human and environmental receptors to residual contamination. ICs are non-engineering mechanisms used to ensure that the intended future land use is consistent with site cleanup and engineering controls, and that these measures maintain their integrity and effectiveness.

For sites necessitating ICs, California Code of Regulations, title 22, section 67391.1 requires the property owner to enter into a LUC to ensure that DTSC will have authority to implement, monitor, and enforce the protective restrictions. LUCs allow on-going use of the property as long as the remedy is not compromised by current or future development. LUCs are intended to protect public health and the environment by preventing inappropriate land use, increasing the probability that the public will have information about residual contamination, ensuring that long-term mitigation measures are carried out by protecting the engineering controls and remedy, and ensuring that subsequent owners assume responsibility for preventing exposure to contamination. The LUC should provide for an annual inspection and annual report to ensure that the LUC continues to be protective. The LUC should also provide for preparation and submittal of five-year reviews.

LUCs may include soil management plans to ensure that soil is handled in such a way to prevent human and ecological exposure. These plans address soil excavation, soil stockpiling, stockpile characterization, soil disposal, soil reuse, construction dewatering, worker training, health and safety, and site inspection.

California Code of Regulations, title 22, section 67391.1 requires that a LUC imposing appropriate limitations on land use shall be executed and recorded with the local county recorder's office when hazardous materials, hazardous wastes or constituents, or hazardous substances will remain at the property at levels which are not suitable for unrestricted land use. The regulation requires DTSC to clearly set forth and define land use limitations or covenants in a remedy decision document prior to approving or concurring with any facility closure, corrective action, remedial or removal action, or other response actions. In addition to these regulatory requirements, it may also be prudent to coordinate with the local planning department regarding the LUC requirements. Further information regarding LUCs is available on the DTSC website.

After the LUC is recorded, if a proposed use of the property is inconsistent with the LUC requirements and/or would increase the risk of exposure to contaminants at the site,

additional actions must be conducted to ensure that the property meets cleanup standards appropriate for the proposed use. Additional sampling and risk characterization for further cleanup actions may be required, and the LUC may be rescinded or modified as appropriate.

11.2 REGULATORY OVERSIGHT AGREEMENT

A regulatory oversight agreement will be required for the period during which the SVE system is operated and until the site is certified. Examples include Corrective Action Consent Agreements and O&M Agreements.

11.3 OPERATION AND MAINTENANCE PLAN

Any regulatory oversight agreement should reference or include the DTSC-approved O&M plan that outlines the procedures and requirements for on-going O&M of the SVE system. Section 9.3.6 describes selected elements of an O&M plan.

11.4 CONTINGENCY PLAN

Any regulatory oversight agreement should reference or include a contingency plan that will be implemented in the event that an immediate response action is required to ensure protection of human health and the environment. Also, the contingency plan should address steps to be taken if performance assessment indicates that the removal action is insufficient and/or will not achieve the RAOs. The contingency plan may be a stand-alone document or may be included as an element of the O&M plan.

11.5 FINANCIAL ASSURANCE

Financial assurance can be accomplished by several mechanisms and will assure that sufficient monies are available to implement any required corrective action activities and on-going O&M activities, conduct necessary five-year reviews, and pay the regulatory oversight costs associated with those activities and IC implementation. These on-going costs should be included in the cost calculation utilized in the remedy selection process. The USACE Manual discusses considerations for estimating costs of constructing and operating SVE systems.

11.6 FIVE-YEAR REVIEW

The regulatory oversight agreement and the O&M plan should include provisions for conducting five-year reviews. The purpose of the five-year review is to ensure that the remedy remains protective of human health and the environment, is functioning as designed, and is maintained appropriately by O&M activities. The review generally addresses the following questions:

- Is the remedy functioning as intended?
- Are the cleanup objectives, goals, and criteria used at the time of cleanup alternative selection still valid?

- Have there been significant changes in the distribution or concentration of impacted soils at the site?
- Are modifications needed to make the remedy or the O&M plan more effective?

The five-year review may also include a remedy optimization evaluation (e.g., sustainability assessment), as discussed further in the *Interim Advisory for Green Remediation* (DTSC, 2009d).

The scope of the five-year review may be outlined in the O&M plan or in a separate workplan developed for a specific review. The following should be incorporated into the five-year review:

- notification of the community that the review is being conducted;
- inspection of the remedy;
- review of the data demonstrating the performance of the system;
- review of other components of the remedy; and
- preparation of a report that details the findings and recommendations of the review.

The *Comprehensive Five-Year Review Guidance* (USEPA, 2001a) may be a useful resource when conducting these reviews.

Depending on site-specific considerations, the inspection and/or technical assessment may be conducted by DTSC and/or the responsible party. DTSC will review the report and make recommendations, if necessary, to ensure that the remedy remains effective, to identify milestones toward achieving or improving effectiveness, and to provide a schedule to accomplish necessary tasks.

The five-year review report should be prepared in conformance with standard geologic and engineering principles and practice using appropriately licensed and experienced professionals.

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GLOSSARY

Brownfields. Brownfields are properties that are contaminated, or thought to be contaminated, and are underutilized due to perceived remediation costs and liability concerns.

Capillary fringe. Zone of soil immediately above the water table. The soil pores in this zone act like capillary tubes casing groundwater to rise within the pore. The water in this zone is retained under suction. At the base of the capillary fringe most soil pores are completely filled with water. At the top of the capillary fringe, only the smallest soil pores are filled with water.

CERCLA. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was enacted by Congress on December 11, 1980, and amended in 1986, by the Superfund Amendments and Reauthorization Act (SARA). This law provided broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA established prohibitions and requirements concerning closed and abandoned hazardous waste sites, provided for liability of persons responsible for releases of hazardous waste at these sites; and established a trust fund to provide for cleanup when no responsible party could be identified.

CEQA. The California Environmental Quality Act (Public Resources Code, §21000 et seq) requires public agencies to consider and disclose the environmental implications of their decisions, and to eliminate or reduce the significant environmental impacts of their decisions whenever it is feasible to do so.

Chemical of concern (COC). Chemicals of concern (COCs) are the compounds exceeding screening levels and are carried forward into the risk assessment.

California Human Health Screening Levels (CHHSLs). Developed by the Office of Environmental Health Hazard Assessment (OEHHA) as a tool to assist in the evaluation of contaminated sites to estimate the degree of effort that may be necessary to remediate a contaminated property. CHHSLs are concentrations of contaminants in soil, soil gas, or indoor air that the Cal/EPA considers to be below thresholds of concern for risks to human health.

Cleanup goal. Concentration value against which the success or completeness of a cleanup effort is evaluated.

Conceptual site model (CSM). Tool to help organize and communicate information about the site characteristics. It provides a summary of how and where contaminants are expected to move, and who might be exposed to chemicals and how it explains what a problem is and why a response is needed.

Corrective Measures Study (CMS). The Corrective Measures Study is the mechanism for the development, screening, and detailed evaluation of alternative corrective actions under the corrective action process.

Exposure point concentration (EPC). The exposure point concentration (EPC) is a conservative estimate of the average chemical concentration in the environmental media.

Feasibility Study (FS). Under the National Contingency Plan process (used by DTSC under California HSC Chapter 6.8), the feasibility study is the mechanism for the development, screening, and detailed evaluation of alternative remedial actions.

Hazard Index: Refers to the cumulative, noncarcinogenic health hazard estimate for a site.

HSAA. Hazardous Substances Account Act, Health and Safety Code, division 20, chapter 6.8.

HWCL. Hazardous Waste Control Law, Health and Safety Code, division 20, chapter 6.5.

Institutional Control (IC). ICs are actions, such as legal controls, that help minimize the potential for human exposure to contamination by ensuring appropriate land or resource use.

Interim Actions. Interim actions are short-term response actions performed pursuant to CERCLA or HSAA to control on-going risks while site characterization is underway or before a final response action is selected.

Interim Measures. Interim measures are short-term response actions performed pursuant to RCRA or HWCA to control on-going risks while site characterization is underway or before a final response action is selected.

Land Disposal Restriction (LDR). The Land Disposal Restriction (LDR) program found in federal and State regulations requires waste handlers to treat hazardous waste or meet specified levels for hazardous constituents before disposing of the waste on the land. To ensure proper treatment, the regulations establish a treatment standard for each type of hazardous waste. The regulations list these treatment standards and ensure that hazardous waste cannot be placed on the land until the waste meets specific treatment standards to reduce the mobility or toxicity of the hazardous constituents in the waste.

Land Use Covenant (LUC). Written instruments used to require compliance with certain obligations and restrict use of property. Land use covenants run with the land and are recorded at the county recorder's office so that they will be found during a title search of the property deed.

National Contingency Plan (NCP). The National Oil and Hazardous Substances Pollution Contingency Plan [40 Code of Federal Regulations sections 300.1 - 300.920], more commonly called the National Contingency Plan or NCP, is the federal government's blueprint for responding to both oil spills and hazardous substance releases.

Non-time-critical removal action. Non-time-critical removal actions, as defined by CERCLA, are removal actions that the lead Agency determines, based on the site evaluation, are appropriate, and a planning period of at least six months is available before on-site activities must begin.

Preliminary Endangerment Assessment (PEA). Under DTSC (2004), the Preliminary Endangerment Assessment (PEA) includes activities performed to determine whether current or past waste management practices have resulted in the release or threatened release of hazardous substances or materials which pose a threat to public health or the environment.

RCRA. The Resource Conservation and Recovery Act, an amendment to the Solid Waste Disposal Act to address the huge volumes of municipal and industrial solid waste generated nationwide. Under RCRA, USEPA has the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also sets forth a framework for the management of non-hazardous wastes. [Title 40 of the Code of Federal Regulations, Parts 239 through 282]

Remedial Action Plan (RAP). Under the HSAA, the RAP is the response action selection document for a remedial action for which the capital costs of implementation are projected to cost $2,000,000 or more.

Removal Action Workplan (RAW). Under the HSAA, the RAW is the response action selection document for a nonemergency removal action that is projected to cost less than $2 million at a hazardous substance release site. Typically, these are actions designed to stabilize or cleanup a site posing a threat to human health or the environment, either as an interim action or the final remedy.

Risk assessment: The scientific process used to estimate the likelihood that a chemical detected at a site may be harmful to people or the environment.

Risk management: The process of evaluating alternative regulatory and non-regulatory responses to risk and selecting among them. The selection process necessarily requires the consideration of scientific, legal, economic and social factors.

Risk screening. Process of identifying COCs that need to be cleaned up on the site based on potential risk to human health. Screening involves a comparison of site media concentrations with risk-based values (e.g., CHHSLs).

Screening level. Concentration value used to evaluate whether a cVOC poses a risk to human health and should be identified as a COC.

Site characterization. Process of determining the type, quantity, and location of contaminant releases at a site. Also includes assessment of site characteristics that affect how and where the contaminant may be moved and the how human health and the environment are or may be affected.

Soils. Loose material on the surface and in the subsurface of the earth consisting of solids (i.e., mineral grains, organic matter), water, and air.

Soil vapor. Air or gas phase compounds in soil pore spaces.

Soil vapor extraction (SVE). SVE is used to remediate vadose zone soil by applying a vacuum that induces the controlled flow of air to remove volatile and some semivolatile organic contaminants from the soil.

Time-critical removal action. Where a release or threatened release poses an imminent or substantial risk to health or environment and a timing period of less than six months exists, a time-critical removal may be employed to prevent a release of contaminants or minimize its risk. For these types of removal actions, evaluation and reporting requirements are kept to a minimum to expedite the response.

Vadose zone. The zone between the land surface and the top of the groundwater table. Water within this zone is referred to as soil moisture.

APPENDIX A
CONCEPTUAL SITE MODEL FOR CHLORINATED VOLATILE ORGANIC COMPOUNDS

This appendix presents the conceptual site model (CSM) for chlorinated volatile organic compounds (cVOCs) in the environment to illustrate potential contaminant migration pathways from a release point into subsurface soil and groundwater. The CSM presented herein is a simplified description of complex real-world systems and serves as a framework to illustrate the behavior of cVOCs so that appropriate characterization and remediation strategies can be developed. This appendix is meant to help practitioners visualize and interpret the spatial variability of cVOCs in the subsurface and to assist practitioners in developing site-specific CSMs. Figure A-1 illustrates the conceptual model for cVOC transport, as adapted from Rivett (1995).

Subsurface cVOC contamination is caused by releases from sources such as landfills, leaking pipes, underground storage tanks, aboveground spills, and aboveground facilities with operations that use chlorinated solvents. Such subsurface cVOCs may exist as contaminated soil gas, contaminated soil, non-aqueous phase liquid (NAPL) in soil or groundwater, and as dissolved-phase contamination in groundwater. NAPL contamination can be of particular concern due to higher contaminant concentrations and its persistence in the environment.

NAPL Plumes

After a liquid cVOC release, the NAPL may be fully contained in the vadose zone or may penetrate the water table to form NAPL pools below the water table as well as leaving a trail of residual NAPL along its migration pathway in both the vadose zone and saturated zone. NAPL may also accumulate near the water table if downward migration is slowed by conditions in the capillary fringe, hard pan zones, or other subsurface features. Where this occurs, subsequent water table fluctuations can produce a “smear zone” of residual NAPL that affects cVOC distribution in the vadose and saturated zones. The presence of these smear zones also affects the types of remedies that will be effective at a given site.

Because cVOC releases typically occur at or near the ground surface, transport mechanisms in the vadose zone are primarily responsible for soil gas and water table plume formation. As shown in Figure A-1, soil gas and water table plumes can have similar spatial footprints. NAPL present in, or close to, the saturated zone will produce dissolved-phase groundwater plumes. These groundwater plumes can have lengths greater than a thousand feet for dissolved-phase cVOC constituents that are not readily biodegradable. Dense NAPL can penetrate below the water table and migrate under the influence of gravity in directions opposite of groundwater flow. Accordingly, dense NAPL sources can be present in different places than would be expected by simply mapping the advective flow of groundwater alone, making sources difficult to find and delineate. Dissolved-phase plumes will emanate from the entire continuous, vertical distribution of NAPL in the groundwater (see Figure A-1).

Soil Gas Plumes

When released to the vadose zone, the cVOC vapors will migrate laterally by diffusion in all directions, potentially tens of meters away from NAPL sources (Silka, 1988; Mendoza and Frind, 1990). The cVOC vapors also will migrate upward toward the ground surface (possibly intruding into buildings) and downward toward the water table, contaminating groundwater by direct contact. Also, cVOCs in soil gas contaminate groundwater by partitioning into infiltrating recharge water within the vadose zone pore space. These processes produce water table plumes that are wide (relative to the groundwater flow direction) and spatially coincident with soil gas plumes.

As shown in Figure A-1, soil gas contamination can migrate laterally upgradient of the groundwater flow direction, potentially contaminating the water table upgradient of the source area. Consequently, in many cases, cVOC contamination detected in groundwater monitoring wells upgradient from release points may not be attributable to offsite sources. Rather, cVOCs in upgradient wells may be caused by lateral diffusional transport of contaminated soil gas followed by subsequent direct contact with groundwater or partitioning into infiltrating recharge water. Also, as groundwater flows away from cVOC sources areas, the dissolved-phase contaminants may partition from the aqueous-phase back into the vadose zone, contaminating soil gas. This soil gas contamination, which is further from NAPL sources than predicted by radial diffusional migration, may produce soil gas concentrations that pose a risk via the indoor air exposure pathway. Therefore, even distal portions of cVOC groundwater plumes located under residential or commercial buildings may produce unacceptable indoor air exposure scenarios.

Groundwater Plumes

The plan views in Figure A-1 illustrate the discrepancies in plume widths that should be recognized when delineating groundwater contamination in the saturated zone. Water table plumes are wide and spatially coincident with soil gas contamination. Deeper plumes will not be much wider than the NAPL source zone due to the weakness of transverse and horizontal dispersion (Anderson et al., 1992). These deeper groundwater plumes can avoid detection if sampling locations are spaced inappropriately. Practitioners should also recognize that saturated zones separated by aquitards may have different groundwater flow directions. Therefore, a deep groundwater plume may have a different spatial orientation than its associated water table plume.

Aquifer homogeneity should also be considered when developing a CSM. For saturated zones within relatively homogeneous subsurface conditions, deep NAPL sources generate narrow dissolved-phase contaminant plumes, and are expected to be directly under the cVOC release point. However, in aquifers within heterogeneous subsurface conditions, deep NAPL sources also may be laterally offset from the release point. For heterogeneous conditions, investigation efforts should assess contaminant distribution in both high and low permeability materials.

CSM Development

The CSM is a representation of the nature, extent, and fate of cVOCs that allows assessment of the potential exposures to contamination. Stakeholders use the CSM to evaluate strategies to protect public health and the environment. The CSM is a scientific hypothesis that is tested, modified, and refined until confident decision-making is possible. Typically, a CSM integrates subsurface characterization with a pathway-exposure assessment, and contains the following elements: contaminant sources; potential release mechanisms; affected environmental media; exposure pathways; and human and ecological receptors. The CSM is developed early and updated throughout the site characterization process. The CSM is a communication tool to direct risk-specific site sampling. Additional information for the development of a CSM can be found in USEPA (1996), USEPA (2008), and DTSC (2008).

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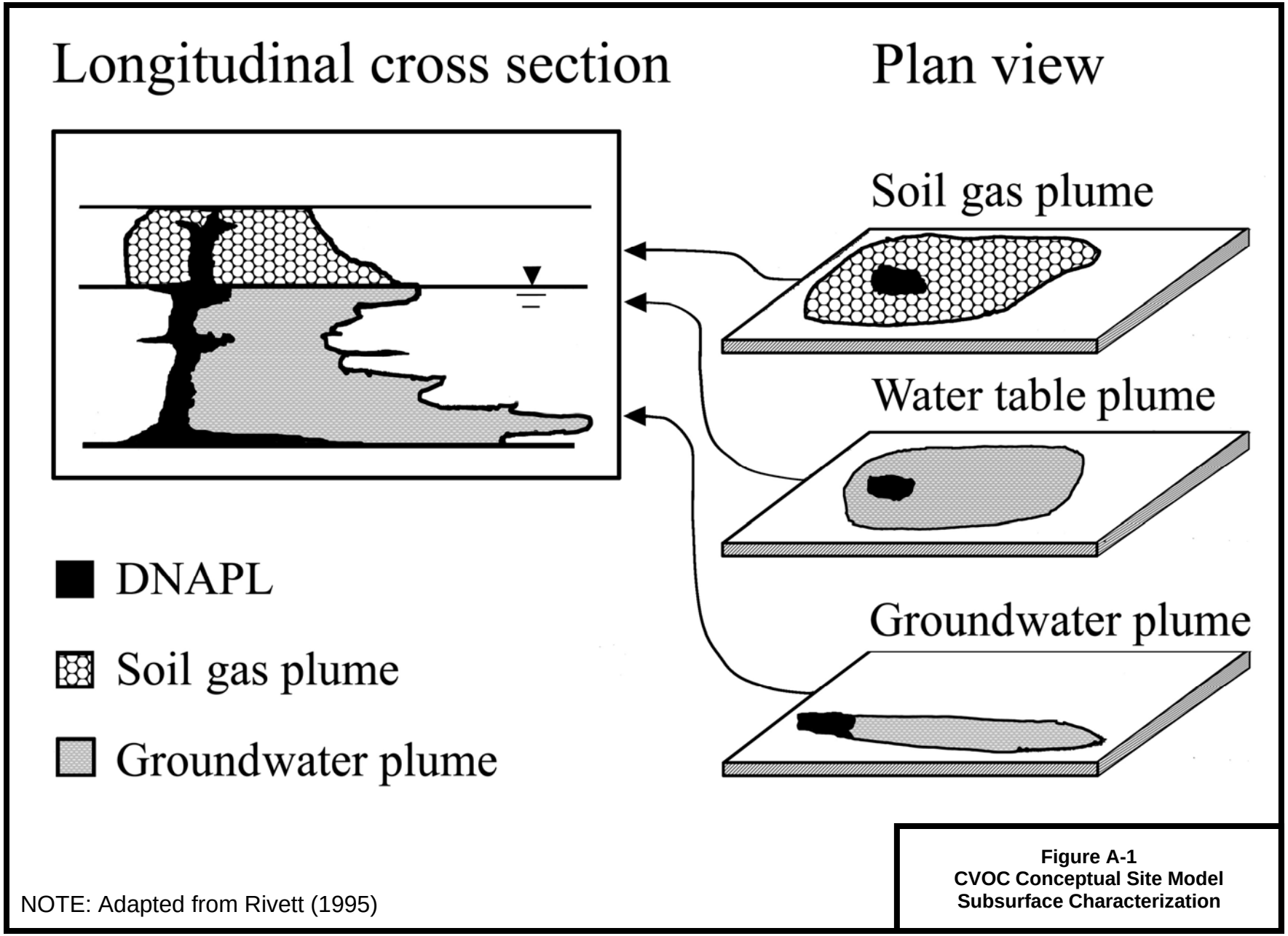

NOTE: Adapted from Rivett (1995)

**Figure A-1
CVOC Conceptual Site Model
Subsurface Characterization**

APPENDIX B

SUPPORTING DOCUMENTATION FOR DTSC TECHNOLOGY SCREENING

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Table B-1 Cleanup Options Selected for cVOCs in Vadose Zone Soil and Characteristics of Sites Evaluated by DTSC Study

DTSC Site Type (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Corrective Action (16[2])	1	14	0	6	0	0
Military Facilities (19[2])	3	12	0	6	2	0
Schools (3)	0	1	0	2	0	0
State Response/ NPL (33[2])	7	19	0	17	4	1
Voluntary Cleanup (19[2])	4	11	2	13	0	0

Total number of sites represented: 90

Depth to First Groundwater (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
≤ 10 feet bgs (9[2])	2	3	0	6	1	0
>10 to 20 feet bgs (13[2])	3	5	0	10	2	0
>20 to 50 feet bgs (25[2])	4	15	1	14	0	1
>50 to 100 feet bgs (16[2])	3	14	0	2	1	0
> 100 feet bgs (12[2])	1	12	1	3	0	0

Total number of sites represented: 75 (Information on depth to groundwater not available for all 90 sites.)

Affected Media (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Soil / soil vapor only (4[2])	1	2	0	3	1	0
Groundwater (86[2])	13	60	2	40	5	1
Surface water (1)	0	0	0	1	0	0
Indoor air (22[2])	5	22	0	7	0	0

Total number of sites represented: 90

Table B-1 (Continued)

Primary cVOCs Detected	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Trichloroethene	12	45	2	33	4	1
Tetrachloroethene	12	40	1	30	5	1
Trichloroethane	6	10	0	8	2	0
Dichloroethane	1	7	1	3	1	0
Chloroform	0	3	0	1	0	0
Methylene chloride	1	1	0	1	0	0
Carbon tetrachloride	1	3	0	0	0	0
Other	0	9	0	1	0	0

Total number of sites represented: 88 (Information detected cVOCs not available for all 90 sites.)

Contaminants Other than cVOCs	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
None reported	4	13	1	10	2	0
Metals	8	24	1	22	2	1
Fuel-related compounds, including BTEX	7	26	0	21	3	1
Semi-volatile organic compounds	3	10	0	4	1	1
Polynuclear aromatic hydrocarbons	0	7	0	5	0	1
Polychlorinated biphenyls	3	6	0	9	2	1
Pesticides	0	4	0	5	1	0
Dioxins/furans	0	3	0	1	0	0
Other	1	8	0	5	0	0

Total number of sites represented: 86 (Information on other contaminants present not available for all 90 sites.)

Table B-1 (Continued)

Historical Site Activity (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Manufacturing/ industrial activities (38[2])	3	25	0	21	1	1
Aircraft manufacturing, operations, maintenance (12[2])	3	8	1	3	0	0
Metal plating, finishing (8[2])	1	5	1	3	1	0
Dry cleaners (8[2])	1	4	0	4	1	0
Solvent recycling/ reclamation (5[2])	1	4	0	3	0	0
Disposal (10[2])	2	3	0	5	2	0
Equipment maintenance/ repair (3[2])	2	2	0	3	1	0
Research facility, laboratory (3[2])	0	3	0	1	0	0
Chemical distribution, packaging (3[2])	1	3	0	0	0	0

Total number of sites represented: 90

Current or Planned Land Use (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Commercial/ industrial (55[2])	10	38	2	22	3	1
Residential, potentially residential, mixed use (15[2])	3	7	0	13	1	0
School/ church (4[2])	0	2	0	3	0	0
Natural area (1)	0	1	0	0	0	0

Total number of sites represented: 75 (Information on potential future use not available for all 90 sites.)

Table B-1 (Continued)

Site Size (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
≤1 acre (15[2])	2	8	0	10	1	0
>1 – 10 acres (38[2])	7	23	2	21	2	0
>10 – 50 acres (19[2])	3	13	0	9	1	0
>50 – 100 acres (3)	0	1	0	1	0	1
> 100 acres (2[2])	1	1	0	0	1	0

Total number of sites represented: 77 (Information on site size not available for all 90 sites.)

Notes:
bgs below ground surface
BTEX Benzene, toluene, ethylbenzene, xylene
cVOCs chlorinated volatile organic compounds
NPL National Priorities List
1 IC is institutional control. Used in conjunction with another cleanup option.
2 Some sites in this category selected multiple cleanup options (i.e., this number is not simply the sum of frequencies listed in this row).

Table B-2 Technologies Applicable at Sites with Chlorinated VOCs in Vadose Zone Soil

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***Ex Situ* Technologies**[1]				
Excavation and Off-site Disposal	Impacted soil is excavated and isolated within an engineered disposal unit (e.g., landfill, CAMU).	• Wide variety of soils and contaminants.	• Cost. • Transportation of impacted soils to off-site disposal facility. • Does not lessen toxicity, mobility, or volume of hazardous wastes.	
Capping	Impacted soil is isolated in place beneath an engineered cap or excavated and isolated within an engineered disposal unit (e.g., landfill, CAMU).	• Wide variety of soils and contaminants.	• Long-term maintenance. • Land use restrictions. • Not protective if groundwater is shallow. • Likely will require a gas collection system to control contaminant vapor migration. • By itself, cannot prevent the horizontal flow of water through the waste, can only reduce the vertical entry of water into the waste.	
Slurry Phase Bioremediation	Slurry-phase bioreactors are used to treat halogenated VOCs using cometabolites and specially adapted microorganisms. Slurry is created by combining soil with water and other additives and mixing to keep solids suspended and microorganisms in contact with the soil contaminants. Upon completion of treatment, the slurry is dewatered and treated soil is disposed of.	• Favored over *in situ* biological treatment for -heterogeneous soils, -low permeability soils, -areas where underlying ground water would be difficult to capture, or -when faster treatment times are required.	• Less reliable for treatment of cVOCs than other *ex situ* biological treatment options. • Requires bench and pilot scale studies. • Difficulty and cost of sizing materials prior to placement in reactor. • Nonhomogeneous and clayey soils can create materials handling problems. • Must remove free phase contaminants prior to treatment. • Cost of dewatering soil fines after treatment. • Requires acceptable method for disposing of nonrecycled wastewaters.	2, 5

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***Ex Situ* Technologies[1]**	**(Continued)**			
Biopiles	Excavated soils are mixed with soil amendments, placed in aboveground enclosures, and subjected to aerated bioremediation and composting process. Treatment units typically require liner, pad, leachate collection system, and aeration system.	• Can treat some cVOCs, though most commonly used to treat fuel-related compounds.	• Requires bench and pilot scale studies. • Questionable effectiveness for halogenated compounds in soil. • Volatile constituents tend to evaporate rather than biodegrade during treatment. • May require air emission controls. • May result in less uniform treatment than processes involving periodic mixing.	2, 3, 5
Landfarming (also known as Land Treatment)	Excavated soil is amended and applied into aboveground beds that are periodically turned over or tilled to aerate the soil. Treatment units typically require a liner and berms, and potentially a leachate collection system.	• Treating aerobically degradable, non-volatile contaminants. • Can treat some cVOCs, but most successfully used for treating petroleum hydrocarbons.	• Requires bench and pilot scale studies to verify that technology can meet RAOs. • May not be best treatment option for cVOCs based on cost and effectiveness. • Harder to degrade organic compounds having a higher degree of chlorination. • Concentration reductions greater than 95% and constituent concentrations less than 0.1 ppm are difficult to achieve. • Volatile constituents tend to evaporate rather than biodegrade during treatment. • Likely will require emission controls. • Difficult to control conditions affecting biological degradation (e.g., temperature, moisture). • Large amount of space is required.	2, 4, 5

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***Ex Situ* Technologies[1]**	**(Continued)**			
Composting	Controlled biological process which treats organic contaminants under thermophilic conditions (54 to 65° C). Contaminated soil is excavated and mixed with bulking agents and organic amendments. Three common designs include aerated static piles, in-vessel, windrow composting.	• Soils contaminated with biodegradable organic compounds.	• Substantial space is required. • Amendments cause volumetric increase. • Off-gas control and treatment may be required. In-vessel composting provides the best control of VOCs. When a vacuum is applied, aerated static piles offer some control of VOCs. • Most costly *ex situ* biological treatment option. • Design requirements (e.g., need for liner, aeration method, temperature) depend on type of design.	2, 5
Chemical Extraction	Contaminated soil and an extractant (e.g., solvent, acid) are mixed in an extractor. Extracted solution is separated into contaminants and extractant for treatment and further use. Physical separation steps are often used before chemical extraction to grade the soil into coarse and fine fractions (assuming much of contaminant is associated with fine fraction).	• Shown to be applicable for separation of organic contaminants such as in paint wastes, synthetic rubber process wastes, and petroleum refinery oily wastes. • Commercial-scale units are in operation, varying in regard to extractant employed, type of equipment used, and mode of operation. • Commonly used in combination with other technologies, such as solidification/stabilization, incineration, or soil washing.	• Some soil types and moisture content levels will adversely impact process performance. • Higher clay content may reduce extraction efficiency and require longer contact times. • Capital costs can be relatively high. • May be more economical at larger sites. • Extractant effects (e.g., acidity, toxicity) on treated soil may need to be addressed. • Less reliable than other *ex situ* physical/ chemical treatment options. • Typically requires longer cleanup time than other *ex situ* physical/ chemical treatment options.	2

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***Ex Situ* Technologies[1]**	**(Continued)**			
Dehalogenation	Soil is screened, processed with a crusher and pug mill, and mixed with reagents. Mixture is heated in a reactor. Replaces halogen molecules or causes decomposition and partial volatilization of contaminants.	• Typically used for halogenated SVOCs and pesticides. • Can be used to treat some halogenated VOCs. • Can be used for small-scale applications	• Generally more expensive than other technologies. • Concentrations of chlorinated organics greater than 5% require large volumes of reagent. • High clay and moisture content will increase treatment costs. • Capture and treatment of residuals may be difficult, especially when the soil contains high levels of fines and moisture.	2
Thermal Desorption	Soil is heated to volatilize water and organic contaminants. A carrier gas or vacuum system transports volatilized water and organics to the gas treatment system.	• Full spectrum of organic contaminants, including VOCs.	• May be less cost-effective than other treatment technologies. • Incidental combustion may occur in some thermal treatment units. • Emission controls and permitting requirements. • Particle size and materials handling requirements can impact applicability or cost at specific sites. • Dewatering may be necessary to achieve acceptable soil moisture content levels. • Clay and silty soils and high humic content soils increase reaction time.	2, 4
Incineration	High temperatures, 870-1,200 °C, are used to combust (in the presence of oxygen) organic constituents in hazardous wastes.	• Used to remediate soils contaminated with hazardous wastes, particularly chlorinated hydrocarbons, PCBs, and dioxins.	• Typically requires transport of impacted soils over long distances. • High cost and energy usage. • Feed size and materials handling issues can impact applicability or cost. • Off gases and combustion residuals generally require treatment.	2

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***In Situ* Technologies**				
Soil Vapor Extraction (SVE)	Vacuum is applied through extraction wells to create a pressure/concentration gradient that induces gas-phase volatiles to be removed from soil via extraction wells.	• Volatile compounds. • Often promotes *in situ* biodegradation of low-volatility organic compounds. • Can remove contamination under existing structures.	• Higher vacuums required for soil with high percentage of fines or high degree of saturation, increasing costs and/or limiting effectiveness. • May be less effective in heterogeneous soil. • Reduced removal rates for high organic content or extremely dry soils. • Exhaust air may require treatment. • Residual liquids from off-gas treatment may require treatment/disposal. Spent activated carbon will require regeneration or disposal. • Not effective in saturated zone. • May not be able to address shallow VOC sources because of short circuiting. • Subsurface infrastructure (e.g., pits, vaults) may limit treatment effectiveness.	2, 6
Thermally Enhanced SVE	Heating is used to increase volatilization rate and facilitate extraction. Heating options include conductive heating, steam/hot air injection, and electrical resistance/ electromagnetic/fiber optic/radio frequency	• Option for treating VOCs if high moisture content is limiting the effectiveness of standard SVE.	• Same as for SVE. • Tight or high moisture content soil has reduced air permeability and requires more energy input to increase vacuum and temperature. • Soil with highly variable permeabilities may result in uneven delivery of gas flow to contaminated areas. • Hot air injection has limitations due to low heat capacity of air.	2

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***In Situ* Technologies**	**(Continued)**			
Thermal Desorption	Applies heat to impacted soil by *in situ* methods. Heat can destroy or volatilize organic chemicals. As chemicals change into gases, mobility increases, and gases can be extracted and treated in an *ex situ* treatment unit. Similar heating options as thermally-enhanced SVE.	• Used with a wide range of soil types and volatile contaminants. • Can remove contamination under existing structures.	• Uncertainty about uniformity of treatment because of variability in soil characteristics and because process efficacy is difficult to verify. • High utility costs.	2
Cometabolic Bioventing	Air and a volatile organic substrate (e.g., propane) are delivered to contaminated unsaturated soils by forced air movement to elicit production of monooxy-genase enzymes which consume the organic substrate and facilitate contaminant degradation.	• Lightly chlorinated compounds in vadose zone.	• Limited experience with technology, particularly with cVOCs. Requires bench scale and pilot testing to demonstrate effectiveness for a given site. • Difficulty of distributing gases in subsurface. • May be difficult to apply to shallow contamination.	5
Anaerobic Bioventing	Nitrogen and an electron donor (e.g., hydrogen, carbon dioxide) are delivered to contaminated unsaturated soils by forced air movement (injection) to produce reducing conditions, thereby facilitating microbial dechlorination.	• May be useful in treating highly chlorinated compounds.	• Emerging technology. Requires bench, pilot, and field demonstrations to confidently apply this technology. • Difficult to distribute gases in subsurface. • Design must compensate for poor permeability conditions. • May be difficult to apply to shallow contamination.	5

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***In Situ* Technologies**	**(Continued)**			
Soil Flushing	Water, or water containing a solubility-enhancing additive (e.g., surfactant), is applied to soil or injected into ground water to raise water table into contaminated soil zone. Contaminants are leached into ground water, which is then extracted and treated.	• Can be used to treat VOCs, but may be less cost-effective than other technologies.	• Potential for washing contaminant beyond capture zone. Should be used only where flushed contaminants and soil flushing fluid can be contained and recaptured. • Water quality concerns with introducing surfactants to subsurface. • May alter the physical/chemical properties of the soil system (e.g., effective porosity). Can reduce contaminant mobility. • Low permeability or heterogeneous soils are difficult to treat. • Aboveground separation and treatment costs for recovered fluids can drive the economics of the process.	2
Chemical Oxidation	Chemically converts contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. Rate and extent of degradation of target compound are dictated by its chemical properties and susceptibility to oxidative degradation. Matching the oxidant and *in situ* delivery system to contaminants and site conditions is key to successful implementation and achieving performance goals.	• Capable of achieving high treatment efficiencies for cVOCs over short time periods.	• Potential contaminant mobilization. If applied to vadose zone soils, need to address mobilization of contaminants and oxidation byproducts to groundwater. • Requires bench and pilot scale studies. • Oxidant delivery problems due to reactive transport and soil heterogeneity. • Short persistence of some oxidants due to fast reaction rates. • Natural oxidant demand may be high for some soils (e.g., high organic matter content, high reduced minerals, carbonates, free radical scavengers). • Potential permeability reduction. • Health and safety concerns with handling strong oxidants.	2, 7

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***In Situ* Technologies**	**(Continued)**			
Phytoremediation	Process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment.	• May be applicable for remediation of cVOCs in shallow soils.	• Depth of treatment zone is determined by plants used in phytoremediation. In most cases, it is limited to shallow soils. • Treatment effects may be seasonal. • Longer cleanup time than other technologies. • Can transfer contamination across media, e.g., from soil to air.	2, 8

1 *Ex situ* technologies assume excavation of soil prior to application of technology
2 Van Deuren and others (2002)
3 USEPA (2004)
4 ITRC (1997)
5 USEPA (2006)
6 USACE (2002)
7 Huling and Pivetz (2006)
8 USEPA (2005)

Table B-3 Evaluation of Technologies Applicable to Sites With Chlorinated VOCs in Soil Against National Contingency Plan Analysis Criteria

TECHNOLOGY	NCP CRITERIA						
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	LONG-TERM EFFECTIVENESS	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Institutional Controls	• **Manages potential exposure by restricting access and future land use.**	• May not comply with ARARs.	• Uncertain because does not permanently address contamination.	• Not a treatment alternative.	• Does not create risks during implementation	• Easily implemented.	• Typically the lowest cost alternative.
Excavation and Off-site Disposal	• Protectiveness achieved by cVOC removal from site.	• Requires compliance with applicable State and federal requirements for waste handling, storage, transportation and disposal requirements.	• High long-term effectiveness for site. • Protectiveness at disposal site dependent on off-site management choices.	• Disposal reduces mobility. • Reduction in toxicity and volume depends on offsite management choices.	• Requires standard precautions necessary for protection of human health and environment during excavation, transport, and disposal. • **cVOC emissions may require control during excavation and handling.**	• **Easily implemented for shallow soils, if feasible site logistics**, and facility with adequate capacity for waste type, located within a reasonable distance of site. • Uses standard construction equipment and labor.	• Usually reasonable for small to medium volumes of contaminated soil. • May be **cost-prohibitive** for large volumes.

Note: Bold indicates major reason(s) rejected during alternatives analysis for sites evaluated by DTSC Study (see Chapter 7 of main text).

Table B-3 (Continued)

TECHNOLOGY	NCP CRITERIA						
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	LONG-TERM EFFECTIVENESS	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Soil Vapor Extraction (after USEPA, 1993)	• Provides short-term and long-term protection by reducing concentration and exposure to cVOCs in soil. • Depending on site-specific conditions, prevents or decreases further groundwater contamination.	• Does not trigger land disposal requirements. • Because of limited disturbance, few impacts to water and sensitive resources are likely. • Potential to treat cVOC concentrations to levels that will prevent exceedance of groundwater cleanup levels. • Emission controls are needed to comply with air quality standards.	• Effectively removes contamination source. • **Proven technique for removing cVOCs from soil at depths with adequate air permeability.** • Requires some treatment of residuals. • Requires review during on-going operation. • Periodic reviews may be required if residual levels of cVOCs remain after system shutdown.	• Significantly reduces toxicity, mobility, or volume through treatment or removal of cVOCs. • Produces few waste streams.	• Potential air emissions easily controlled. • Generally involves relatively short timeframe to achieve RAOs. • Effective for treating cVOC mass under buildings. Can be performed on active sites. • Equipment is readily available.	• Readily available technology. • Proven technology. • Requires few engineering controls. • Requires soil gas sampling to monitor cleanup progress and demonstrate achievement of RAOs.	• Can be cost effective.

Note: Bold indicates major reason(s) rejected during alternatives analysis for sites evaluated by DTSC Study (see Chapter 7 of main text).

Table B-3 (Continued)

TECHNOLOGY	NCP CRITERIA						
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	LONG-TERM EFFECTIVENESS	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Containment by Capping	• Contaminated soil remains in place. Depending on site conditions, **cVOCs may migrate laterally and vertically beneath cap unless controlled.** • Risk of exposure through inhalation, dermal contact and/ or incidental ingestion reduced through barriers. • **Groundwater protection** depends on depth to water, potential for cVOC migration, and cap design that reduces water migration through soil.	• Waste disposal requires compliance with ARARs.	• Long-term protection ensured through **continued cap maintenance, ICs, and, if needed, emissions controls.**	• **Not a treatment alternative.**	• Requires standard precautions for protection of human health and environment.	• Commercially available. • Demonstrated technology. • Necessary materials easily attainable. • Uses standard construction equipment and labor.	• Generally less expensive than most forms of treatment.

Note: Bold indicates major reason(s) rejected during alternatives analysis for sites evaluated by DTSC Study (see Chapter 7 of main text).

Table B-3 (Continued)

TECHNOLOGY	NCP CRITERIA						
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	LONG-TERM EFFECTIVENESS	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
In Situ Treatment	• Protectiveness achieved by transforming cVOCs and achieving target cleanup levels. • **Potential for cVOC mobilization to groundwater.**	• Requires compliance with applicable State and federal requirements for treatment process.	• Permanently destroys cVOCs, if reagent successfully placed in contact with impacted soils. • **Uncertain effectiveness.** • **Some technologies unproven for cVOCs in unsaturated soils.** • **Some technologies can be effective for specific cVOCs.**	• Reduces toxicity, mobility, and volume of soil contaminated with cVOCs.	• Requires standard precautions for protection of human health and environment during treatment process (e.g., reagent handling).	• Assess applicability through bench scale and treatability studies. • May require permit for treatment process. • Equipment availability depends on selected treatment process. • **Time to treat.** • Some treatments require large power source. • **Ability to achieve geochemical conditions needed for treatment.**	• Relatively high **cost**.

Note: Bold indicates major reason(s) rejected during alternatives analysis for sites evaluated by DTSC Study (see Chapter 7 of main text).

Table B-3 (Continued)

TECHNOLOGY	NCP CRITERIA						
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	LONG-TERM EFFECTIVENESS	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Ex Situ Treatment	• Protectiveness achieved by treatment in above-ground units and achieving cleanup goals for on-site reuse or for land disposal.	• Requires compliance with applicable State and federal requirements for excavation, treatment transportation, storage, and disposal. • Emission controls likely needed to comply with air quality standards.	• **Some techniques can be effective for specific cVOCs.** • **May require additional technology if cleanup goals not achieved.**	• Removes cVOCs or transforms cVOCs to less toxic by-products.	• Potential short-term risks from emissions during excavation, treatment, soil handling, and transportation. • Requires standard precautions for protection of human health and the environment during treatment process.	• **May require bench and pilot scale studies.** • May have multiple treatment steps. • **On-site treatment requires space for treatment unit.** • **Off-site treatment requires transport to treatment facility.** • Administrative requirements for permitting treatment unit may delay project.	• Relatively high **costs,** particularly for off-site treatment and disposal.

Note: Bold indicates major reason(s) rejected during alternatives analysis for sites evaluated by DTSC Study (see Chapter 7 of main text).

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APPENDIX C

RESOURCES FOR DESIGN AND IMPLEMENTATION OF SVE SYSTEMS

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ACRONYMS AND ABBREVIATIONS

Cal/EPA	California Environmental Protection Agency
CEQA	California Environmental Quality Act
cm/s	centimeters per second
CSM	conceptual site model
cVOC	chlorinated volatile organic compound
DQO	data quality objective
DTSC	California Department of Toxic Substances Control
GAC	granular activated carbon
GRA	Groundwater Resources Association of California
LARWQCB	Los Angeles Regional Water Quality Control Board
LEL	lower explosive limit
O&M	operation and maintenance
PT&R	proven technologies and remedies
QA	quality assurance
QC	quality control
QAPP	quality assurance project plan
RAO	remedial action objective
ROI	radius of influence
SVE	soil vapor extraction
SVM	soil vapor monitoring
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

Preface

This appendix supplements Chapter 9 of this guidance document by providing additional information about selected topics for soil vapor extraction (SVE) systems. The intent is to facilitate the design and implementation of SVE systems. Please refer to the main text of this guidance document for an overall discussion of the design and implementation of SVE systems as well as discussion of site characterization, cleanup technology screening and evaluation, and remedy selection. Please recognize that this appendix and Chapter 9 are intended as guidance. All elements discussed may not be applicable to a given site.

1.0 TREATMENT TECHNOLOGIES FOR SVE SYSTEM EFFLUENT

This discussion summarizes the likely treatment methods for SVE system effluent. A comprehensive discussion of the engineering design of air emission control devices is beyond the scope of this PT&R guidance and would duplicate information in *Engineering and Design - Soil Vapor Extraction and Bioventing* (USACE Manual; USACE, 2002) and *Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice* (USEPA, 2006). Off-gas treatment systems may not be necessary for a given SVE system if emissions are below regulatory levels or health-based goals (health risk analysis).

1.1 GENERAL OBJECTIVE OF EFFLUENT TREATMENT

Effluent treatment methods need to be designed to treat a wide range of volatile chemicals and concentrations. Chlorinated volatile organic compound (cVOC) concentrations can span several orders of magnitude between system startup and shutdown, and therefore the effluent treatment system must operate properly for the anticipated concentration ranges. The consequences of the treatment process itself must be considered in selecting the construction materials. Disposal of residuals such as spent carbon and condensate must also be addressed. The following considerations are needed for design of effluent treatment systems:

- initial and long-term concentration ranges
- complete analysis and speciation of the influent gas
- total flow rate range
- required removal efficiency
- availability of utilities
- required degree of control, monitoring, and automation
- noise generation
- condensate control and proper management (e.g., secondary containment)

Additional case-specific considerations may be applicable, such as local agency air emissions requirements or California Environmental Quality Act (CEQA)-identified

mitigation needs. Communication between the designers of the subsurface and aboveground components is essential.

1.2 TYPICAL EFFLUENT TREATMENT OPTIONS

Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice (USEPA, 2006) provides detailed discussion of effluent treatment options for cVOCs, including thermal treatment, adsorption, and emerging technologies such as vapor condensation. This section discusses treatment technologies used by the majority of Department of Toxic Substances Control (DTSC) projects, namely granular activated carbon (GAC) and thermal treatment. Experience on DTSC projects has found that GAC is often the chosen method of treatment even though thermal treatment may be the most efficient and cost effective approach. Thermal treatment may be the best option for waste streams containing vinyl chloride because vinyl chloride does not adsorb onto GAC. Ketones, methane, chlorofluorohydrocarbons, and sulfur-containing compounds are examples of other compounds that are not suitable for GAC treatment.

1.2.1 Sorbents

Sorbents can remove many classes of organic compounds including aromatic, aliphatic, and halogenated hydrocarbon compounds. Adsorption of volatile contaminants occurs via chemical and physical attractive forces between liquid or gas phase molecules and the molecules of the solid sorbent activated carbon, zeolites, or synthetic polymers. Selection of an appropriate sorbent material is primarily a function of the contaminant to be adsorbed. Activated carbon is the most widely used adsorbent material and is the focus of the remainder of this discussion.

Many SVE systems utilize GAC in flow-through canisters which are relatively simple to operate when properly designed. A carbon adsorption design usually includes multiple columns which are operated either in series or in parallel. The series arrangement is generally operated so that the secondary and subsequent columns (if applicable) act as a backup when breakthrough occurs on the primary canister. When the lead column is removed from service, the lag column is moved up to the lead position and the new column (or regenerated column) is installed in the lag position. The pressure / temperature ratings of the GAC canisters must exceed the anticipated operating conditions of the SVE system equipment.

Adsorption is normally a reversible process. Under suitable conditions the materials that have accumulated in the carbon can be desorbed and the carbon can be re-used. Thermal reactivation is the most widely used regeneration technique. In SVE systems where carbon usage is low, on-site regeneration will not be cost-effective and the spent carbon should be either disposed of or regenerated offsite. For larger long-term SVE systems, onsite regeneration should be considered based on a complete life-cycle cost economic analysis. If possible, the designer should estimate the total carbon usage for the life of the project and compare the carbon cost with the capital and operation and maintenance (O&M) cost of the regeneration system. A similar economic analysis could be performed for comparison with catalytic and thermal oxidation, as discussed below.

1.2.2 Thermal Oxidation

The four general types of thermal oxidation systems available for controlling cVOC emissions include:

- direct flame thermal oxidizers
- "straight-through" flameless thermal oxidizers
- regenerative thermal oxidizers
- catalytic oxidizers

Although each type of system operates somewhat differently, the primary goal of thermal oxidation is to raise the temperature of the gas stream to a sufficient level to promote oxidation (or combustion) of the contaminant to carbon dioxide and water. The heat for thermal oxidation comes from heat input to the oxidizer in the form of supplemental fuel (either gas or electric) as well as from the heating value content (usually in British thermal units) of the cVOCs in the SVE vapor streams. In-line flame arrestors should be incorporated into the design when using thermal oxidizers. Placed just upstream of thermal oxidizers, flame arrestors can prevent fire from moving through piping, and can protect other parts of the SVE system from fire or explosion.

Issues to be considered when evaluating thermal oxidation options include:

- cost savings that can be achieved by heat recovery techniques
- adjustment of the amount of auxiliary fuel (or dilution air) to accommodate variations in mass loading
- for catalytic oxidation, consideration of the catalyst type and catalyst limitations (e.g., deactivators, overheating, lifespan)
- generation and treatment of acidic emissions (i.e., gases, liquids)
- potential generation of products of incomplete combustion (e.g., chlorinated dibenzo-p-dioxins, chlorinated dibenzofurans)
- lower explosive limit (LEL) of the waste stream[1]

Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice (USEPA, 2006) provides guidance on selecting a thermal treatment technology.

[1] The LEL is defined as the minimum concentration of chemical vapor in atmospheric air (i.e., 21% oxygen and at 20°C) that is sufficient to support combustion.

2.0 VACUUM, FLOW, AND ZONE OF CAPTURE ASSESSMENTS

2.1 VACUUM AND FLOW ASSESSMENT

Two main types of assessments may be performed during pilot-scale testing or validation/startup activities: step tests and steady-state tests. DTSC recommends use of both a step and steady-state vacuum/flow assessment.

2.1.1 Step Test

Step testing is used to determine the optimum sustainable flow from the subsurface. During step testing, the flow is incrementally increased over time as the vacuum level in the SVE well and vapor monitoring wells is documented. The flow rate is increased by manipulating the blower system.

2.1.2 Steady-State Test

The steady-state or constant rate test is implemented at the optimum flow rate to acquire vacuum data from the subsurface and to determine potential maximum influent cVOC concentrations for the SVE system and the optimal SVE well spacing. This vacuum data is obtained from multiple monitoring locations. Typically, an optimum flow rate is derived from step testing and used as a parameter in steady-state testing. The stabilized vacuum readings obtained from monitoring well infrastructure during steady-state testing are used to define the full-scale zone of capture of the SVE treatment system.

2.2 ZONE OF CAPTURE ASSESSMENT

Zone of capture is the most important parameter to be considered in the design of a SVE system because it controls the mass removal rate and thus the efficiency and timeframe for site cleanup. Also referred to as the zone of remediation, the zone of capture is defined as the greatest distance from a SVE well at which a sufficient vapor flow can be induced to adequately enhance volatilization and extraction of the soil contaminants. The rate of mass removal via volatilization is a function of the volume of air passing by the contaminated soil per unit of initial contaminant mass.

Experience with SVE systems has shown that, for effective mass removal rates, zone of capture typically ranges between 40 and 100 feet. A smaller zone of capture is often needed to enhance mass removal rates in heterogeneous or fine-grained soil. A smaller zone of capture may also be needed to improve mass removal efficiencies and thus meet specific project deadlines (e.g., timeframe to begin redevelopment). The zone of capture appropriate for a SVE system should be evaluated on a site-specific basis, preferably using the method described in Section 2.2.1 or 2.2.2. On a case-by-case basis, DTSC may consider proposals to demonstrate an appropriate zone of capture during the system startup and validation process (see Section 2.2.4 for further discussion).

Regardless of the method used to estimate the zone of capture, performance data collected during pilot testing and/or system startup and validation and on-going operations should be used to confirm the adequacy of the initial zone of capture estimate. If the evaluation indicates that the zone of capture estimate was inaccurate, the system may require modification so that the RAOs can be achieved. See Section 2.2.4 for further discussion.

2.2.1 Pore Gas Velocity Approach

The approaches described in USACE (2002) and DiGiulio and Varadhan (2001a) can be used for the quantification of SVE system zone of capture. These approaches are based on the pore gas velocity and consist of two general steps. First, air permeability of the subsurface is determined. Then, the subsurface pore velocities associated with a SVE well, and the resulting zone of capture, are calculated using the air permeability. Typically, the zone of capture is defined by soil pore velocities of 0.01 cm/s (DiGiulio and Varadhan, 2000, 2001a) or greater. (Note: The zone of capture is inversely proportional to the pore gas velocity.) SVE wells should be placed so that their zones of capture completely cover the area of contamination with a slight overlap.

USACE (2002) and DiGiulio and Varadhan (2001a) should be consulted for detailed description and the technical basis for zone of capture derived from pore gas velocity estimates. A generalized description of the pore gas velocity approach is summarized below. Other appropriate methods may also be used.

Step 1. Vacuum response data are used to estimate the permeability ratio (ratio of horizontal to vertical permeability) and horizontal air permeability of the subsurface. These estimates can be determined using software designed for SVE system data analysis. Typical input parameters include:

- vacuum response data for monitoring points around each SVE well tested
- estimate of flow conditions (e.g., steady state, transient)
- estimate of subsurface conditions (e.g., leaky, semi-confined)
- blower flow rate
- estimated gas-filled porosity

Multiple scenarios (using realistic input parameters) should be used to find a reasonable approximation of the permeability ratio and horizontal air permeability.

Step 2. The air permeability ratio, horizontal air permeability, and other input parameters are used to estimate the pore gas velocity. This estimate can be modeled using software designed for SVE data analysis using an appropriate model domain, grid, boundary conditions, and input parameters. Typical input parameters include:

- permeability ratio / air permeability (e.g., as described in Step 1)
- blower flow rate
- anisotropy angle in the main principal flow direction[2]

[2] Obtained from literature values with consideration of site conditions

- soil porosity
- irreducible water saturation[2]
- van Genuchten soil-water retention parameters[2]

Multiple simulations, using realistic ranges of input parameters, are conducted to calibrate the model with a set of input parameters that provides the least average error between observed and simulated vacuum measurements at monitoring points. The calibrated model is then used to simulate the vacuum distribution and calculate pore gas velocity. To design the SVE system, this pore gas velocity can then be used to calculate a critical pore gas velocity[3] that results in an advection-dominated system.

Step 3. The pore gas velocity obtained in Step 2 is used to estimate the zone of capture for each SVE well. The USACE Manual recommends that critical pore gas velocities of 0.001 and 0.01 cm/s be used for design purposes.

2.2.2 Semi-Analytical Approach

An approach for the quantification of SVE system zone of capture is available that does not rely on the use of air permeability and pore gas velocities. The approach, which is described in Johnson and Ettinger (1994), utilizes SVE well extraction rates and subsurface contaminant mass estimations. Johnson and Ettinger (1994) should be consulted for detailed description, the technical basis, and potential limitations for the quantification of zone of capture by this method. When using this method, SVE wells should be placed so that zones of capture completely cover the area of contamination with a slight overlap.

The zone of capture is determined using Equation 6 of Johnson and Ettinger (1994). Selected parameters used by Equation 6 are described below.

Vapor Extraction Rate. The extraction rate for a single SVE well should be determined through pilot testing or estimated from professional experiences at nearby sites.

Contaminant Mass. The subsurface contaminant mass should be accurately quantified using both soil gas and soil matrix data. To obtain the most representative estimates of contaminant mass, soil matrix samples should be collected using USEPA Method 5035 (DTSC, 2004). Soil gas samples should be collected in accordance with *Advisory – Active Soil Gas Investigations* (DTSC/LARWQCB, 2003; revision pending).

Remediation Time Estimates. The timeframe for achievement of cleanup around the SVE well is needed to quantify zone of capture. By increasing the remediation timeframes, the zone of capture also increases proportionately.

[3] DiGiulio and Varadhan (2001b) defines a critical pore gas velocity as the pore gas velocity that results in slight deviation from equilibrium conditions (i.e., sufficient flow rate through soil to reduce cVOC concentrations in the soil gas phase and thereby create a driving force for further cVOC volatilization, desorption, and diffusion into soil gas for removal by advective transport).

Gamma parameter (γ). This parameter is a dimensionless measure of the progress of remediation. The value should be less than or equal to 1.0 for the quantification of zone of capture.

Alpha parameter (α). This parameter is the minimum volume of air per unit contaminant mass required to achieve cleanup under ideal conditions. The value should be at least 100 cubic meters of air per kilogram of contaminant mass for the quantification of zone of capture.

This semi-analytical approach is based upon the concept that the SVE effectiveness is a function of the volume of air that flows through the contaminated soil. Please note that zone of capture quantified with this method does not truly reflect the two-dimensional nature of the remediation process and should be used cautiously with contingencies to modify the SVE system as appropriate based upon post-implementation site-specific data.

2.2.3 Other Methods (Not Preferred)

Historically, the zone of capture has been referred to as the radius of influence (ROI) and has been derived using following methods that are no longer considered to be appropriate.

Pore Volumes. Assessment of minimum zone of capture is based on an estimate of the pore volume exchanges required to allow diffusion to reduce contamination to allowable levels. The total number of exchanges is divided by the maximum period of treatment to determine the exchange rate per year. The maximum flow rate of the SVE well is used in conjunction with the pore volume requirements to develop well spacing capable of achieving these treatment requirements. The method requires estimates of the contaminant mass in the vadose zone which can be difficult to quantify and typically provide a poor basis for a meaningful design zone of capture.

Graphical Regression. This method uses vacuum data collected from monitoring well infrastructure located around a central SVE well. Typically, this method uses a plot of steady-state vacuum levels versus distance from the central SVE well to the monitoring well data point. The zone of capture would be based on the volume of soil in which a selected minimum vacuum value (e.g., 0.2 inches of water) was present. However, vacuum response in the subsurface is independent of air permeability. Hence, the arbitrary selection of an observed vacuum as the definition of zone of capture is not a good indicator of the subsurface treatment zone.

As discussed further below, use of a zone of capture derived from these methods likely facilitates capture (containment) of contaminant vapors, but does not consider mass removal rates and other factors that can effect cleanup efficiency (e.g., contaminant/soil distribution, mass transfer considerations, chemical partitioning).

The graphical regressive method using subsurface pressure has been the method most often applied by practitioners. However, the zone of effective air exchange is often

much smaller than a ROI based upon pressure measurements (Johnson and Ettinger, 1994; Beckett and Huntley, 1994; Shan et al., 1992) and does not provide an estimate of the zone of effective air exchange in the subsurface. This issue is best discussed in Chapter 3 of USACE (2002):

> *"Historically, r_e [radius of pressure influence] has been used as the basis of design for extraction well networks. Designers have interpreted the zone of vacuum influence around a well as also corresponding to the "capture zone" of the extraction well. By subsequently selecting an arbitrary distance within this zone of vacuum influence, designers have established well spacings for SVE well networks. Unfortunately, this is a completely inappropriate interpretation of this phenomenon. . .SVE designs should be based on pore gas velocities or the rates of pore gas exchange, which, are a function of both the pressure (vacuum) distribution around the extraction point and the associated soil air permeability."*

2.2.4 Contingencies for SVE System Modification Based on Performance Data

The methods described in Sections 2.2.1, 2.2.2, and 2.2.3 can be used to develop the SVE well spacing. Regardless of the method used, the adequacy of the initial SVE well spacing should be verified based on performance data collected during the system startup and validation, and on-going operations. If the performance data indicate that the initial zone of capture estimate is inadequate, the system should be redesigned.

On a case-by-case basis, DTSC may consider proposals to demonstrate an appropriate zone of capture during the system startup and validation process, provided that:

- an adequate vapor monitoring well network is constructed as part of the initial system design;
- the design plan includes provisions for future SVE well installation based on operational data;
- the design plan includes a detailed strategy and procedures for system startup, testing, validation, and commissioning;
- a system validation and startup report is submitted; and
- DTSC is consulted and concurs with the decision.

In this instance, professional judgment would be used to develop a realistic initial estimate of the likely zone of capture. This initial estimate would be based on site characterization, experience at similar or nearby sites, and site-specific RAOs.

The system startup and validation report and subsequent status reports (see Section 6.0) should provide results, discussion of physical parameters (air permeability, measured zone of capture, air exchange rate, etc.), discussion of concentration trends in vapor monitoring wells and SVE wells, and discussion of other soil gas flow parameters. If the zone of capture used as the design basis is inadequate to achieve site-specific RAOs, the reports should document or provide recommendations for system modifications (such as the installation of additional SVE wells). Persistently

elevated concentrations even after system operation may be another indicator of the need for system modifications and re-design.

3.0 VAPOR WELL CONSTRUCTION AND PLACEMENT

3.1 SOIL VAPOR EXTRACTION WELLS

3.1.1 Construction

USEPA and USACE provide recommendations for SVE well construction. Typically, DTSC recommends a minimum of two-inch diameter SVE wells, but larger diameter wells should be considered if pressure loss is of concern.

3.1.2 Placement

To achieve maximum efficiency from a SVE well field, the SVE well screen intervals should be placed vertically to provide effective air flow through soils where cVOC concentrations exceed RAOs. The screen interval position should be determined through site characterization data (e.g., lithology, concentration etc,), modeling, startup testing, and/or pilot testing. Some wells should be targeted toward the interface between permeable and recalcitrant zones. At some sites, efficiency may be achieved by screening the SVE wells in the lower part of the target zone in order to reduce downward air flow from the ground surface, thus decreasing the air flow rate and resultant need to oversize blower and effluent treatment system. Well spacing should be selected to allow overlapping zone of capture between SVE wells. Overlapping zones of capture may produce “stagnant” zones that should be considered in the system design (GRA, 2007).

3.1.3 Additional Extraction Well Capacity

The number of SVE wells installed for a SVE system should be increased as necessary to meet the RAOs. The need for additional SVE wells should be evaluated based on pilot test data, initial performance data, system validation/startup performance data, and/or other monitoring data. Flexible system design (e.g., blower size, treatment capacity, vapor monitoring well location) will facilitate incorporation of additional SVE wells into the system.

3.2 SOIL VAPOR MONITORING WELLS

Monitoring well infrastructure is needed for design, operation, and closure activities. The monitoring wells are integral to the operation and closure activities associated with full-scale operation. Although multiple monitoring wells will be installed to support the pilot test or system validation/startup, additional monitoring wells may be needed based on the size of the full-scale SVE treatment system and if vapor monitoring wells are converted to SVE wells.

3.2.1 Construction

DTSC recommends construction of vapor monitoring wells with PVC materials and with a diameter of one to two inches (or larger to allow conversion to a SVE well). Typically, three to five foot interval screen intervals are preferred for vapor monitoring wells. Alternative construction methods consisting of dedicated, limited length screen intervals (i.e., six inches) attached to tubing are not recommended.

3.2.2 Well Placement

Multiple, multi-depth, discrete-interval monitoring wells should be located in different directions and varying distances from the SVE wells. At a minimum, vapor monitoring should occur at three locations from the SVE wells. Each monitoring location should screen multiple, discrete depths. The lateral and vertical placement of monitoring wells relative to the SVE wells should be based on the estimated zone of capture for the SVE well.

3.2.3 Screen Intervals

Monitoring wells should be screened in the most contaminated soils. Considerations for selecting potential zones for vapor monitoring well screen intervals include placement:

- in both permeable and recalcitrant zones
- at depths corresponding to desirable soil type
- with consideration of the SVE well screen intervals
- to allow evaluation of changes in the cVOC concentrations
- to allow evaluation of zone of capture
- to demonstrate achievement of the RAOs

4.0 OPERATIONAL ASSESSMENT FOR SVE SYSTEMS

Operational assessment of a SVE system is a combination of field instrumentation data (i.e., vacuum gage, photoionization detector, flow meter) and speciated cVOC analyses from the SVE treatment system (influent/effluent, SVE wells) and soil vapor monitoring wells. Initially, the SVE system is run at design specifications until monitoring data indicates a need for modifications to enhance cVOC recovery. Continued system operation will lead to a decrease in influent stream concentration that necessitates system optimization (Section 4.1) and eventually rebound assessment (Section 4.2). The USACE Manual (USACE, 2002) provides detailed discussion of these topics and additional resources are provided on the USEPA web-site (www.clu-in.org).

4.1 OPTMIZATION

Operation of the SVE system requires continuous optimization to ensure maximum contaminant recovery. The total mass (as evidenced by concentrations measured in SVE well effluent) typically decreases rather quickly within several weeks to a few months of operation and then reaches a condition where total concentration and mass removal rates have stabilized. In general, these conditions occur when the total cVOC concentration in combined extracted vapor does not vary by more than 1 to 5 percent during several consecutive monitoring events. The optimization effort should begin at the onset of the full-scale operation. However, when total cVOC concentrations stabilize, it becomes particularly important to optimize because it will shorten the operation time for the SVE system. This optimization effort should be documented in an appropriate report.

4.1.1 Potential Optimization Activities

Optimization activities generally consist of adjusting the SVE system air flow capacity such that the vapor extraction is occurring from the wells having the highest mass removal rates or closest to zones with cVOC concentrations exceeding RAOs. Potential optimization activities might include:

- rebalancing the air flow capacity to SVE wells with the highest mass removal rates and/or nearest to zones where RAOs have yet to be achieved; this rebalancing would include reducing air or eliminating flow at SVE wells producing low mass flow (e.g., wells completed in diffusion-limited areas) and increasing flow from SVE wells that are producing higher mass flow (indicative of an on-going source of vapors);
- reducing the overall system flow rate to address contaminant mass moving primarily by diffusive transport (by use of available frequency control, mechanical pulley changes, or change in blower capacity);
- further characterization of low permeability zones using advanced site characterization tools (such as membrane interface probes, SimulProbe®[4], or equivalent) to create a vertical profile of soil types, cVOC concentrations, and cVOC mass versus depth;
- vertically profiling existing SVE wells using PneuLog®[4] (or equivalent device) to obtain data on the vertical profile of advective and diffusive layers;
- placing additional short-screened SVE wells below or within diffusion-limited zones;
- alternating between SVE wells to reduce power and vapor treatment requirements (such as when diffusion limitations require extended remediation times and lower flow rates); and/or
- adjusting blower/total extraction rate to maximize the rate of contaminant removal.

[4] Use of trade names does not constitute endorsement by DTSC

Higher flow rates or vacuums will generally not improve cVOC removal from low permeability soils. Sites with relatively thin layers (i.e., less than 2 feet) of low permeability soils surrounded by high-permeability sands can be more effectively remediated by using smaller blowers and lowering the flow rates to better address contaminant vapors migrating primarily by diffusive transport. Accepting longer operating times at lower flow rates with less frequent monitoring and sampling is often the most cost-effective strategy for sites with low permeability soils.

4.1.2 Pulse-Mode Operation (Optional)

A SVE system can also be operated in "pulse" mode as a means of system optimization. For evaluation of optimization, the SVE system may be shutdown periodically to evaluate whether subsurface concentrations may "rebound" or "spike". This evaluation is sometimes performed when mass recovery rates decrease. Stabilized total cVOC concentrations in SVE system influent should not be used as the sole basis to support the need for pulse-mode operation. For instance, at highly contaminated sites, the level of influent concentrations may become stabilized, but are high enough to result in significant mass removal (which supports continued SVE system operation). In addition, a number of factors will require evaluation in order to determine if the observed stabilized concentrations are truly reflective of conditions necessitating further optimization through pulse-mode operation.

The pulse-mode operation may begin once the influent concentrations are stabilized and reflective of low mass removal rates. Pulse-mode operation can be implemented in the following steps:

- completing other SVE system optimization actions (see Section 4.1.1);
- operating the SVE system until low mass rates and stabilized influent concentrations are present under optimized operational conditions;
- performing all necessary field and speciated analysis of influent, SVE well, and monitoring well concentrations while system is operational;
- performing all necessary field and speciated analysis of SVE and monitoring well concentrations at end of inoperative period;
- turning the SVE system off for an appropriate period based on concentration trends and/or discussions with DTSC (experience has shown that this is usually a few weeks to a few months);
- turning the SVE system back on and optimizing the operation based on results of latest analyses; and
- repeating this series of activities until analyses indicate that the SVE system is ready for rebound or closure assessment.

If significant mass recovery occurs during the pulse-mode operation of the SVE system, the operator should evaluate whether increased SVE well density would resolve the need for pulse mode operation by providing greater pore velocity in the subject areas.

4.2 REBOUND ASSESSMENT

Rebound assessment requires that the SVE unit is temporarily shut down to evaluate whether subsurface RAOs have been achieved. The timeframe for rebound assessment is a site-specific determination and should have sufficient duration so that the measured soil gas concentrations represent equilibrium conditions at steady-state. A site-specific timeframe for rebound assessment can be determined using the approach described in Johnson et al. (1999).

Rebound assessment requires collection of soil gas samples at equilibrium from SVE wells and vapor monitoring wells. The soil gas samples should be collected pursuant to the *Advisory – Active Soil Gas Investigations* (DTSC/LARWQCB, 2003; revision pending). Monitoring wells are preferred for this assessment because of the shorter screen intervals. These data are compared to the RAOs. Hence, rebound assessment requires:

- baseline samples from site characterization data and/or vapor monitoring wells just prior to pilot-scale testing or system startup;
- samples collected immediately prior to or just after cessation of SVE operations; and
- samples obtained during multiple sampling events at appropriate time increments after cessation of SVE operations. The number of samples should allow visual estimation of concentration trends. The time period over which the samples are collected should consider the estimated time for steady-state concentrations to be reached at each monitoring location.

When soil rebound concentrations indicate a need for further vadose zone remediation, the SVE system is restarted. Typically, only SVE wells that can influence zones requiring additional mass removal should be reactivated (as indicated by data obtained during the rebound assessment). Extraction continues until the concentration of the extracted gas in the inlet stream re-stabilizes and mass removal rates are low. At this point, another shutdown period with soil gas monitoring begins. The cycle continues until steady-state soil gas concentrations in all vapor monitoring wells remain below clean-up goals or until it is apparent that no further progress is being made by the SVE system. An appropriate number of sampling events should transpire over a period of time to demonstrate that residual cVOC concentrations are stable and that the RAOs have been achieved.

5.0 SVE REMOVAL ACTION MONITORING

This section identifies general considerations for the development of a site-specific monitoring approach used to evaluate SVE system performance and remediation progress.

5.1 MONITORING LOCATIONS

During SVE system operation, remedy performance and cleanup progress is monitored by collecting soil gas samples from: treatment system influent, treatment system effluent, SVE wells (Section 3.1), and soil vapor monitoring wells (Section 3.2). Vacuum measurements at SVE and vapor monitoring wells may also be needed. Collectively, these data are used to make decisions about system operations, modifications, optimization, rebound, and shut down (see Section 4.0).

5.2 SAMPLING FREQUENCY

Typically, SVE wells and soil vapor monitoring wells are sampled frequently during SVE system startup to ensure mass removal is occurring as expected and to provide a basis for system adjustments or modifications. Hence, during the SVE system startup, sampling of SVE wells and soil vapor monitoring wells on weekly (or more frequent) basis may be needed. These data are used to assess and adjust system operation. The concentration data obtained during this period are useful comparators when the system enters rebound assessment. The data may also be useful for identifying unknown cVOC sources within the zone of capture of the SVE system.

The sampling frequency can be reduced as the system and concentration behavior becomes better understood. Temporal plots of concentration are useful for evaluating the transition from frequent startup sampling to the reduced frequencies for routine monitoring of the system. For many sites this transition occurs about a month or so after startup.

During routine monitoring, the sampling frequency for a given well should consider its function, location, and concentration behavior. The selected frequency should also consider the expected duration of the removal action (e.g., more frequent sampling for short duration removal actions). Operating SVE wells are often monitored frequently (e.g., monthly, quarterly) to allow timely adjustments to system performance. Soil vapor monitoring wells containing relatively high concentrations may also be sampled relatively frequently (e.g., quarterly) to allow assessment and tracking of concentration behavior. Soil vapor monitoring wells containing relatively low concentrations may warrant a lower sampling frequency with a provision for resampling if unexpectedly high concentrations are detected. The well can be identified for more frequent sampling if the high concentration is confirmed by the resample.

5.3 EVALUATING SVE WELL DATA

SVE well data is used to determine whether concentrations fall within expected ranges and whether adjustments to the SVE system are needed. For example, if concentrations do not decrease by at least one order of magnitude within an expected

timeframe (e.g., after 12 to 18 months of operation), the possible causes of the concentration behavior should be evaluated. Optimization measures such as increasing airflow from selected SVE wells or installing additional SVE wells may be appropriate. As another example, if a SVE well has a relatively low mass removal rate (such as might be caused by diffusion constraints), airflow from this well could be decreased, perhaps allowing increased airflow from another SVE well with a higher mass removal rate. A low mass removal rate may also indicate other potential problems (such as short-circuiting caused by poor annular seals).

5.4 EVALUATING SOIL VAPOR MONITORING WELL DATA

Soil vapor monitoring well data are evaluated to determine whether concentrations are behaving as expected and whether adjustments to the SVE system are needed. Persistently high cVOC concentrations after months of operation may warrant increased airflow from the nearest SVE well or adjustment of airflow in an interfering SVE well. Persistently high concentrations could also indicate the need for an additional SVE well (at an appropriate distance and depth interval). Another option is to use the vapor monitoring well as a SVE well (provided that the casing diameter is adequate and does not produce large fluid energy loss).

5.5 MONITORING DURING REBOUND EVALUATION

During a rebound assessment (Section 4.3), soil gas samples are collected and analyzed at appropriate time intervals. Data from soil vapor monitoring wells are preferred for rebound assessment because of the shorter screen intervals. Significant concentration rebound during the first few sampling events after system shutdown indicates a need to optimize and restart the SVE system. If no significant rebound occurs and the *in situ* concentrations have been monitored and evaluated over an appropriate period of time (pursuant to Johnson et al., 1999), the next step typically is an assessment of whether the system is ready for site closure (Section 7.0).

5.6 SAMPLING TO SUPPORT CLOSURE ASSESSMENT

The closure assessment for a SVE system (see Section 7.0) should be based on data obtained from the inlet stream and depth-specific soil gas data obtained throughout the baseline extent of the vapor plume. The depth-specific data can be collected from existing vapor monitoring wells and from soil gas borings completed in areas of the baseline plume extent that were not specifically monitored during the SVE removal action. The need to confirm the level of vadose zone treatment with soil matrix sample analysis is a site-specific determination that is dependent on the RAOs. Samples should be collected pursuant to Cal/EPA guidance (DTSC, 2004; DTSC/LARWQCB, 2003, revision pending).

6.0 STATUS REPORTS

Periodic status reports should be submitted to DTSC that summarize the performance of the SVE system. The status report contents should be based on pre-defined reporting needs and objectives. Typical topics addressed by status reports may include:

- total mass recovery (including basis for mass calculations)
- graph of cumulative mass removed
- influent/effluent concentration to treatment system
- individual well concentrations
- individual SVE well concentration trends
- trend analysis
- mass emission rate
- operating parameters
  - startup date
  - hours operated during reporting period
  - cumulative operating hours to-date
  - SVE wells in operation
  - operating vapor extraction rate
  - total air volume extracted during reporting period
  - carbon usage
  - caustic usage
  - utility water usage
  - power usage
  - wastewater discharged
  - operating temperature
- deviations to operating system
- causes of shutdown
- O&M activities
- equipment repair and replacement
- optimization efforts
- costs to operate, monitor, and maintain the SVE system
- significant events/activities during reporting period
- scheduled upcoming activities
- map of SVE system
- field documentation (maintenance logs, shutdown logs, checklists)

Additional topics may be appropriate based on site-specific considerations.

7.0 SYSTEM SHUTDOWN AND CONFIRMATION OF CLEANUP

In general, the site is ready for an analysis of SVE system shutdown after:

- the SVE system has been optimized to the extent feasible (Section 4.1);
- rebound assessment (see Section 4.2) indicates that RAOs have been achieved; and
- a sufficient period of time has passed since final system shutdown to allow residual cVOC concentrations to equilibrate to steady-state conditions.

A system may also be ready for shutdown when the performance assessment indicates that no further progress is being made and that additional remedial approaches would be needed to address the remaining contamination.

At sites where the SVE system has achieved RAOs, the closure analysis typically includes:

- preparation of plots of:
  - cVOC concentrations versus time (SVE and monitoring wells)
  - cumulative extracted mass versus time
  - mass removal versus time throughout the SVE operation (including any pulse-mode periods);
- depth-specific soil gas sampling (and soil confirmation sampling if applicable) to assess residual cVOC concentrations throughout the baseline plume extent (Section 5.6);
- documentation of the optimization and rebound assessment efforts (Section 4);
- confirmation sample data analysis and documentation;
- estimated total cVOC mass in the vadose zone after SVE treatment;
- assessment of the potential for residual cVOCs to pose an on-going threat to groundwater and/or human health;
- if residual cVOC concentrations pose a continued threat to groundwater, evaluation of whether the threat can be mitigated by an alternate vadose zone remedy and/or the groundwater remedy; and
- economic feasibility analysis for continued operation of the SVE system (if appropriate).

The USACE Manual (USACE, 2002) and DiGiulio and Varadhan (2001b) provide detailed discussion of SVE system shutdown and cleanup confirmation.

8.0 ANNOTATED OUTLINE FOR SVE SYSTEM PILOT TEST WORKPLAN

Preface: The following annotated outline identifies potential content for a SVE system pilot test workplan. This outline is not intended to be prescriptive and should be adjusted as appropriate for site-specific conditions. Some elements identified may apply to your site, while others may not. Additional elements than are addressed by the outline may also be needed. This outline is for guidance only, and is applicable on a case-by-case basis.

1.0 INTRODUCTION

Instructions: Provide a general description of the site and pilot test area. Present the purpose and scope of the pilot test, including the regulatory framework under which it is being conducted. Identify the performance measures and applicable data metrics to be collected. Identify the response agency. Outline the workplan organization.

- 1.1 Site History, Operations, and Features
- 1.2 Scope and Objectives of Pilot Test
- 1.3 Workplan Organization

2.0 SUMMARY OF EXISTING CONDITIONS

Instructions: This section should orient the reader to the site and provide sufficient background information so that the reader can evaluate the proposed design of the pilot test. Provide an overview of the site geology and hydrogeology. Identify the depth to water and typical water table fluctuation. Summarize available data on the nature and extent of contamination in soil, soil vapor, and groundwater. If applicable, describe results of previous pilot studies. Support this section with appropriate figures and tables.

- 2.1 Site Lithologic and Hydrogeologic Conditions
- 2.2 Soil Quality
- 2.3 Soil Vapor Quality
- 2.4 Groundwater Quality
- 2.5 Results of Previous Pilot Studies

3.0 SITE CONCEPTUAL MODEL FOR VOLATILE CONTAMINANTS

Instructions: Provide a narrative description and schematic diagram of the CSM for cVOCs. Clearly describe the source and current locations of contaminants. Provide figures showing the extent of the soil vapor plume in plan view and in cross-section. Describe the fate and transport of cVOCs in the vadose zone and groundwater. Discuss the potential exposure pathways for the cVOCs (e.g., inhalation from groundwater, vapor intrusion into indoor air, ingestion and dermal contact with contaminated groundwater). Describe any considerations associated with expected emissions from the SVE system.

3.1 Source and Current Location of Contaminants
3.2 Extent of Soil Vapor Contamination
3.3 Transport
3.4 Health Effects of Contaminants

4.0 SELECTION OF RESPONSE ACTION

Instructions: Indicate why the response action is being implemented (e.g., mitigate cVOC-impacted soil and soil vapor, protect of groundwater, protect human health, mass removal). Briefly describe why SVE is considered to be a proven technology and remedy or indicate that the PT&R approach to Remediation of Chlorinated VOCs in Vadose Zone Soils is being used. Provide the rationale for using SVE as the response action at the site.

4.1 Proven Technologies and Remedies
4.2 Soil Vapor Extraction and Treatment

5.0 DESIGN OF SVE PILOT TEST

Instructions: Identify the objectives of the pilot test (e.g., determine air permeability, zone of capture, flow rate/vacuum for blower sizing, condensate production, concentration trends, water table response). Provide a detailed description of the infrastructure that will be used to conduct the pilot test, including all wells, piping, blowers, and treatment components. Identify any noise or CEQA considerations for the pilot test. Indicate the instrumentation that will be used during the test (such as to measure vacuum/pressure, flow, temperature, and barometric pressure). Provide figures illustrating the SVE system layout, treatment system, and instrumentation.

5.1 Pilot Test Objectives
5.2 SVE and Soil Vapor Monitoring Well Design
5.2.1 Well Depths and Spacing
5.2.2 Design and Materials
5.3. Piping
5.4 Treatment System
5.5 Other Infrastructure
5.5.1 Blower
5.5.2 Valves
5.5.3 Monitoring Points
5.5.4 Sampling Ports
5.5.5 Instrumentation
5.5.6 Power Source
5.5.7 Condensate Collection, Storage, and Secondary Containment

6.0 SVE PILOT TEST SYSTEM INSTALLATION

Instructions: Identify the activities to be conducted prior to system installation (e.g., permitting, utilities clearance, stakeholder outreach). Identify health and safety issues associated with system installation. Describe the well installation methods, including drilling methods, any soil sampling and analysis that will be conducted as part of well installation, equipment decontamination, and handling of investigation-derived waste. Indicate the installation requirements for the piping system (e.g., soils management, damage protection, equipment decontamination). Describe the installation requirements for the treatment system and blower.

- 6.1 Pre-Installation Activities
  - 6.1.1 Permitting
  - 6.1.2 Utilities Clearance
  - 6.1.3 Community Relations
- 6.2 Health and Safety
- 6.3 Personnel and Responsibilities
- 6.4 Well Installation
  - 6.4.1 Drilling Methods
  - 6.4.2 Soil Sampling and Analysis
  - 6.4.3 Well Construction and Installation
- 6.5 Piping
- 6.6 Treatment System
- 6.7 Other Infrastructure
- 6.8 Decontamination
- 6.9 Waste Management

7.0 PILOT TEST SYSTEM OPERATION AND MAINTENANCE PROGRAM

Instructions: Outline the O&M program for the system. Provide the procedures for starting up and operating the system (e.g., duration, leak and blockage checks, test operational sequence, step testing, system operational parameter measurements, measurement locations). Identify the data analysis procedures (such as air permeability, zone of capture, system curve construction, mass removal rates, treatment efficiency). Describe the monitoring and sampling program to be implemented during the pilot test, including the measurement/analytical parameters, measurement/sampling frequencies, measurement/sampling locations, methods, and equipment. Identify the system shutdown strategy (e.g., how test completion will be determined, decommissioning, or incorporation into the final remedy). Indicate how the system performance will be evaluated and reported. Identify the type, content, and frequency of reporting. Identify contingencies in the event of system failure or unacceptable performance (i.e., specific actions to be taken, response times, contacts).

- 7.1 System Start-Up
- 7.2 Operating Strategy
  - 7.2.1 Procedures
  - 7.2.2 Data Analysis

7.2.3 Operation Schedule
7.2.4 Contingency Plan
7.3 Shutdown Strategy
7.4 Monitoring and Sampling Program
7.4.1 Operational Parameters
7.4.2 Chemical Parameters
7.5 Performance Evaluation and Reporting

8.0 PROJECT SCHEDULE

Instructions: Provide a schedule for implementing the pilot test.

9.0 REFERENCES

Instructions: Provide the references used to support the pilot test design and workplan.

TABLES
Geologic and Hydraulic Properties of Stratigraphic Layers
Geotechnical Parameter Test Methods

FIGURES
Site Location Map
Site Features Map
Cross Section of Site Stratigraphy
Conceptual Site Model of Vapor Distribution
Soil Vapor Plume Distribution (various depth intervals)
Groundwater Isoconcentration Contour Map
SVE Pilot Test Location Map
Proposed Pilot Test SVE and SVM Well Locations
Proposed Pilot Test SVE and SVM Screen Intervals
Schematic SVE and SVM Well Construction Diagrams
Schematic of SVE Treatment System Process Flow Diagram

APPENDICES
Field Data Sheets
Statement of Qualifications

9.0 ANNOTATED OUTLINE FOR SVE SYSTEM PILOT TEST REPORT

Preface: The following annotated outline identifies potential content for a SVE system pilot test report. This outline is not intended to be prescriptive and should be adjusted as appropriate for site-specific conditions. Some elements identified may apply to your site, while others may not. Additional elements than are addressed by the outline may also be needed. This outline is for guidance only, and is applicable on a case-by-case basis.

EXECUTIVE SUMMARY

1.0 INTRODUCTION

Instructions: Provide a general description of the site and pilot test area. Identify the purpose, scope, and objectives of the pilot test. Identify the performance measures and applicable data metrics. Indicate the regulatory framework under which the test was conducted. Identify the responsible agency. Outline the report organization. Reference the pilot test workplan.

- 1.1 Site History, Operations, and Features
- 1.2 Scope and Objectives of Pilot Test
- 1.3 Report Organization

2.0 PROJECT BACKGROUND INFORMATION

Instructions: Briefly orient the reader to the site and provide sufficient background information so that the reader can evaluate the pilot test results. Support this section with appropriate figures and tables.

- 2.1 Site Setting
- 2.2 Site Background

3.0 PILOT TEST DESCRIPTION, OBJECTIVES, AND PROCEDURES

Instructions: Provide an overall description of the pilot test, including the test objectives, equipment, and procedures. Also describe any departures or exceptions from the workplan.

- 3.1 Remedial Technology Description
- 3.2 Pilot Test Objectives
- 3.3 SVE Well Installation
- 3.4 Pilot Test Equipment
  - 3.4.1 Wells and Piping
  - 3.4.2 Vapor Collection System
  - 3.4.3 Vapor Pretreatment System
  - 3.4.4 Vapor Treatment System

3.4.5 Ancillary Systems
3.4.6 Monitoring Equipment and Instrumentation
3.5 Pilot Test Permitting
3.6 Pilot Test Procedures
3.6.1 Startup and Testing
3.6.2 Performance Tests
3.6.3 System Modifications During Startup

4.0 FIELD AND LABORATORY DATA

Instructions: Describe the monitoring and data collection activities conducted prior to and during the pilot test, including any departures/exceptions from the workplan. Describe the noise readings and locations, including comparison to local noise ordnance requirements. Examples of pre-test data include static water level data, soil and air temperature, static pressure, and atmospheric conditions.

4.1 Field Data
4.1.1 Pre-Test Data
4.1.2 Chemical Parameters
4.1.3 Temperature
4.1.4 Pressure/Vacuum
4.1.5 Flow Rate
4.1.6 Noise Readings and Locations
4.2 Laboratory Data
4.2.1 Geotechnical Data
4.2.2 Chemical Data
4.2.3 Data Quality

5.0 DATA ANALYSIS AND INTERPRETATION

Instructions: Provide an analysis of the test data with references to appropriate in-text tables, graphs, and figures. Include supporting documents as appendices.

5.1 Achievable Flow Rates
5.2 Zone of Capture
5.3 Field Permeability
5.4 Chlorinated VOC Removal Rate
5.5 Effectiveness of SVE
5.5.1 Treated Soil Vapor
5.5.2 Residual Soil
5.5.3 Recovered Condensate

6.0 CONCLUSIONS AND RECOMMENDATIONS

Instructions: Discuss the test findings and whether there is a need for additional work. If applicable, describe the design basis for the full-scale SVE system.

6.1 Overall Effectiveness of Technology
6.2 Needs for Further Study
6.3 Design Basis for Full-Scale System

7.0 REFERENCES

Instructions: Provide the references cited in the report and used as the basis for any calculations.

TABLES

Zone of Capture Data
Vacuum vs. Flow Data
Equipment List
Sampling and Analytical Method Summary
Removal Rate Summary
Zone of Capture Summary
Chemical Analytical Results Summary
Summary of Air Permeability Tests/Calculations
Well Construction Details
Full-Scale SVE Design Parameters

FIGURES

Site Location Map
Site Features Map
SVE Pilot Test Location Map
Cross Sections of Site Stratigraphy and Well Screen Intervals
Schematics of SVE System Layout
As-builts of SVE System
Construction Schematics
Representative Graphs of Air Flow vs. Applied Vacuum
Representative Zone of Capture for Selected Wells
Representative Graphs of Concentrations over Time
Representative Graphs of Response Vacuum vs. Distance
Map of Vacuum Response Isopleths

APPENDICES

Laboratory Analysis Reports
QA Reports
Field Data Sheets
Well Installation and Boring Logs
Air Permeability Evaluation
Zone of Capture Calculations and Evaluation
Flow Rate Calculations
Recovery Rate Calculations for Each Test Well
Graphs of Data for Each Test Well

10.0 ANNOTATED OUTLINE FOR SVE SYSTEM STARTUP AND VALIDATION REPORT

Preface: The following annotated outline identifies potential content for a SVE system startup and validation report, and can be used for sites that had a discrete pilot test phase as well as sites that choose to move directly into the startup/validation phase. As indicated in the outline, sites that moved directly into the startup/validation phase have additional content requirements (as discussed in Chapter 9 of the main text). This outline is not intended to be prescriptive and should be adjusted as appropriate for site-specific conditions. Some elements identified may apply to your site, while others may not. Additional elements than are addressed by the outline may also be needed. This outline is for guidance only, and is applicable on a case-by-case basis.

1.0 INTRODUCTION

Instructions: Provide a general description of the site and area addressed by the SVE system. Present the purpose and scope of the SVE removal action, including the regulatory framework under which it is being conducted. Identify the performance measures and applicable data metrics. Identify the response agency. Briefly orient the reader to the site and provide sufficient background information so that the reader can evaluate the results presented in the report. Outline the report organization.

- 1.1 Site History, Operations, and Features
- 1.2 Scope and Objectives of SVE Removal Action
- 1.3 Background
- 1.3 Report Organization

2.0 SVE SYSTEM COMPONENTS

Instructions: Identify and describe the various components of the SVE system. Include figures of the schematic layout of the treatment system as well as the overall system layout, including piping routes. If applicable, describe the construction and installation of the system components.

- 2.1 Vapor Extraction Wells
- 2.2 Vapor Monitoring Wells
- 2.3 Treatment Units
- 2.4 Vapor Extraction Blower
- 2.5 Conveyance Piping
- 2.6 Monitoring Stations
- 2.7 Utilities

3.0 SVE SYSTEM STARTUP SUMMARY

Instructions: Describe activities and findings during SVE system startup, including duration of startup activities, key dates, system settings and modifications, and the dates, types, and frequencies of monitoring. Describe the types and results of any tests (e.g., step, steady-state, isolation). Discuss the monitoring data obtained during system startup, including induced vacuum, field screening results, and laboratory sampling and analysis. As applicable, describe the system performance under various operational conditions (e.g., different SVE well configurations). If applicable, document the decision process that led to installation of additional SVE wells or a decision not to operate a given SVE well. As applicable, discuss data collected to address site-specific concerns (e.g., noise).

- 3.1 Baseline Soil Vapor Sampling
- 3.2 Initial Startup and Testing
- 3.3 Induced Vacuum
- 3.4 Field Screening
- 3.5 Laboratory Results
- 3.6 Instrumentation Settings
- 3.7 System Modifications During Startup

4.0 SVE SYSTEM OPERATIONS SUMMARY

Instructions: Describe the activities and results of the system operation following the initial startup period. Indicate the period of time reflected in the summary. Include an operation and maintenance summary (e.g., cumulative hours of operation, sorbent changeouts, sorbent consumption rate, system adjustments). Also discuss any administrative changes (e.g., changes to the permit requirements for the system emissions). Discuss inspections of the SVE system, monitoring events, and monitoring results. Identify any trouble-shooting activities, the measures taken, and the outcome.

- 4.1 Treatment Unit Issues
- 4.2 Operation and Maintenance Activities
- 4.3 Troubleshooting
- 4.4 Administrative Changes

5.0 DATA ANALYSIS

Instructions: Provide an interpretation of the data collected during the timeframe addressed by the report, including baseline data collected prior to system startup. Discuss the vacuum/pressure distribution induced by the SVE system. Estimate the pore gas velocity, zone of capture and mass removal rate induced by the SVE system.

- 5.1 5.1 Physical Parameters
  - 5.1.1 Vacuum/Pressure Distribution
  - 5.1.2 Flow Rate
  - 5.1.3 Pore Gas Velocity

5.1.4 Zone of Capture
5.2 Chemical Parameters
5.2.1 Treatment Unit Influent and Effluent
5.2.2 Vapor Wells
5.3 Mass Removal Calculations

6.0 CONCLUSIONS AND RECOMMENDATIONS

Instructions: Provide conclusions regarding the system effectiveness as well as recommendations for on-going operation and maintenance of the SVE system.

7.0 REFERENCES

TABLES

Well Completion Details
Equipment Summary
Operations and Maintenance Summary
Sampling Program
Summary of Samples / Data Collected
Well Data
Influent / Effluent Data
Field Monitoring Data
Field Operations Data
Vacuum Distribution
Flow Rate Calculations
Well Pressure / Flow Relationships
Calculation Summaries (air permeability, pore gas velocity, zone of capture)
Test Results Summaries (step, steady-state, isolation)
Mass Removal Summary

FIGURES

Site Location Map
Site Vicinity Map
Site Plan and Well Locations
Site Conceptual Model / Representative Cross Section
System Layout / As-built
Treatment System Schematic
Schematic System Flow Diagram
Isopressure Contours
Concentration Distribution (multiple depth intervals)
Time Concentration Graphs
Cumulative Mass Removal
Graphs of Test Data
Zone of Capture Extent

APPENDICES

- Permits
- Field Forms and Notes
- Laboratory Analytical Reports
- Residue Disposal Documentation
- Calculations
- Well Completion and Boring Logs
- Construction QA/QC
- Documentation of Residue Disposal

11.0 ANNOTATED OUTLINE FOR SVE SYSTEM DESIGN DOCUMENT

Preface: The following annotated outline identifies potential content for a SVE system design document. This outline is not intended to be prescriptive and should be adjusted as appropriate for site-specific conditions. Some elements identified may apply to your site, while others may not. Additional elements than are addressed by the outline may also be needed. This outline is for guidance only, and is applicable on a case-by-case basis.

1.0 INTRODUCTION

Instructions: Provide a general description of the site and pilot test area. Indicate the purpose of the document. Identify the scope and RAOs of the SVE system (e.g., protect receptors from exposure to cVOCs at the surface, protection of groundwater quality, reduce groundwater cleanup time and cost, and/or restore contaminated areas to support existing and proposed land uses). Identify the performance measures and applicable data metrics. Reference a table summarizing the quantitative cleanup goals. Identify the responsible agency. Outline the document organization.

- 1.1 Site History, Operations, and Features
- 1.2 Purpose of Document
- 1.3 Scope and RAOs of SVE System
- 1.4 Document Organization

2.0 BACKGROUND INFORMATION

Instructions: Orient the reader by providing sufficient background information about the site. Provide a brief overview of the site geology and hydrogeology and direct the reader to key project documents for further information. Provide a synopsis of the current knowledge of the nature and extent of contamination in soil, soil vapor, and groundwater, with a focus on the contaminants to be addressed by the SVE system or that may need to be considered during SVE system operation. Give a brief overview of the SVE technology being applied and indicate why SVE was selected as the remedial technology for the site. If applicable, describe results of previous pilot studies. Support this section with appropriate figures and tables.

- 2.1 Soil Contamination
- 2.2 Soil Gas Contamination
- 2.3 Groundwater Contamination
- 2.4 SVE as Remedial Technology for cVOCs in Vadose Zone

3.0 CONCEPTUAL SITE MODEL FOR VOLATILE CONTAMINANTS

Instructions: Provide the CSM for the SVE system. Identify the principle sources of cVOC contamination and the locations of these sources. If relevant, explain how these sources have changed over time (e.g., small core zone in shallow subsurface surrounded by a soil vapor halo, initial core area expanded by a smear zone caused by dropping groundwater levels). Describe horizontal and vertical extent of the soil vapor plume prior to start-up of the SVE system (e.g., baseline plume extent). Briefly describe the geologic materials to be remediated with emphasis on the characteristics that may affect SVE effectiveness (e.g., grain size, grain size distribution, stratification, moisture content, water table position, organic carbon content). Summarize the conceptual air flow model for the site (e.g., extent of SVE well influence, induced vacuum, air flow characteristics, potential for "short circuiting", slower cleanup of finer grained zones).

- 3.1 Sources of cVOCs
- 3.2 Soil Vapor Plume
- 3.3 Geology
- 3.4 Conceptual Air Flow Model

4.0 SVE IMPLEMENTATION PROCESS

Instructions: Present the overall process for implementing the SVE system. Identify the permit and other administrative requirements. Identify the steps that will be used to startup and test the SVE system (e.g., baseline sampling of vapor wells, the sequence of system startup, flow rate testing, leak checks, monitoring frequencies, types of measurements/samples, treatment unit performance assessment). Discuss the activities associated on-going operation of the SVE system (e.g., measurements/ sampling to assess performance and status, inspections to ensure proper operation of equipment) and reference the O&M plan. Indicate what performance measures might trigger optimization and what steps might be taken to optimize system performance (e.g., modify system flow rates, taking a well off-line, placing additional wells on-line, treatment system adjustments). Outline an initial strategy for curtailment and closure of the SVE system. To assist with the decision process for curtailing or closing the SVE system, provide a table summarizing possible response actions for specific influent concentrations, air flow rates, and/or mass removal rates (e.g., continue operating a given SVE well if the concentration is above a certain value; if the concentration in a given SVE well falls below a given value, turn off a SVE well and evaluate concentration rebound after an appropriate period of time).

- 4.1 Startup and Testing
- 4.2 Long-term Operation
  - 4.2.1 System Status and Performance Monitoring
  - 4.2.2 System Optimization
- 4.3 Curtailment and Closure Strategy

5.0 FIELD SAMPLING PLAN FOR OPERATING SVE SYSTEM

Instructions: Present the rationale, methods, locations, and frequencies for measurement and sampling activities related to SVE system evaluation, startup, operation, optimization, rebound assessment, and eventual closeout. Indicate that field and laboratory work will follow procedures and protocol provided in the QAPP. Address all types of samples and measurements associated with the SVE system (e.g., soil vapor, scrubber sludge, vacuum measurements). Provide tables and figures summarizing the sampling/measurement frequencies for various system components.

- 5.1 Sampling Locations
- 5.2 Sample Collection Procedures and Analytical Methods
- 5.3 Field Quality Control Samples
- 5.4 Sampling Frequencies

6.0 SVE GENERAL DESIGN AND ENGINEERING CONSIDERATIONS

Instructions: Identify the SVE system components and provide the details regarding the design and function of each component. Indicate the design process for the SVE system (e.g., phased approach, total system approach) as well as the planned design submittals and content (e.g., drawing package will include treatment pad layout and details, piping and mechanical details, process and instrumentation diagram, and electrical single line diagram). Describe measures to be used for noise control and other considerations identified in the CEQA process. Describe the procurement process for the system components. Briefly discuss system operations, referring the reader to Section 4.0 for details. Identify the design and engineering documentation that will be prepared (e.g., design package, O&M plan, report addressing observations and difficulties encountered during the start-up period).

- 6.1 Soil Vapor Wells
- 6.2 Soil Gas Collection System
- 6.3 Vacuum System
- 6.4 Emission Control System
- 6.5 Utility Requirements
- 6.6 SVE System Implementation
  - 6.6.1 Engineering Design
  - 6.6.2 Procurement
- 6.7 Design Submittals
- 6.8 Construction Activities
- 6.9 Operations
  - 6.9.1 Startup and Initial Operations
  - 6.9.2 Long-Term Operations
  - 6.9.3 System Optimization
- 6.10 Documentation

7.0 SVE SYSTEM OPERATIONS REPORTING

Instructions: Indicate the types and frequency of reports to be provided. Identify the purpose, objectives, and typical content of each report.

- 7.1 Status Reports
- 7.2 Periodic Monitoring/Operations Reports

8.0 RESIDUALS MANAGEMENT

Instructions: Identify the residuals that will generated by the SVE system and how the residuals will be managed. Describe any requirements (such as secondary containment) for residual storage areas.

- 8.1 Liquids/Water
- 8.2 Sediments/Solids

9.0 QUALITY ASSURANCE PROJECT PLAN

Instructions: Present the organization, functions, procedures, and specific QA and QC activities designed to achieve the DQOs for the SVE system.

- 9.1 Project Management
  - 9.1.1 Title and Approval Sheet
  - 9.1.2 Table of Contents
  - 9.1.3 Distribution List
  - 9.1.4 Project Organization
  - 9.1.5 Problem Definition/Background
  - 9.1.6 Project/Task Description and Schedule
  - 9.1.7 Data Quality Objectives and Criteria for Measurement Data
  - 9.1.8 Special Training Requirements/Certification
  - 9.1.9 Documentation and Records
- 9.2 Measurement/Data Acquisition
  - 9.2.1 Sampling Process Design
  - 9.2.2 Sampling Method Requirements
  - 9.2.3 Sample Handling and Custody Requirements
  - 9.2.4 Analytical Methods Requirements
  - 9.2.5 Quality Control Requirements
  - 9.2.6 Instrument Testing, Inspection, and Maintenance Requirements
  - 9.2.7 Instrument Calibration and Frequency
  - 9.2.8 Inspection/Acceptance Requirements for Supplies and Consumables
  - 9.2.9 Data Acquisition Requirements (Non-Direct Measurements)
  - 9.2.10 Data Management
- 9.3 Assessment/Oversight
  - 9.3.1 Assessments and Response Actions
  - 9.3.2 Reports to Management

9.4 Data Validation and Usability
9.4.1 Data Review, Validation, and Verification Requirements
9.4.2 Validation and Verification Methods
9.5 Technical Data Management

10.0 REFERENCES

Instructions: Provide the references cited in the document.

TABLES
Cleanup Goals
General SVE System Operation Parameters
Soil Parameters
Soil Gas Sampling Locations and Frequency
Emissions Sampling Frequency
Residuals Sampling Frequency
Measurement and Analytical Methods
QC Acceptance Criteria
QA Objectives for Emissions
Sample Container and Holding Time Requirements

FIGURES
Site Location Map
SVE System Location Map
SVE System Process Flow Diagram

APPENDICES
Field Data Sheets
Health and Safety Plan
Standard Operation Procedures
Vadose Zone Modeling
Calculations
Operations and Maintenance Plan
Pilot Test Report

12.0 REFERENCES

Beckett, G.D. and D. Huntley. 1994. Characterization of Flow Parameters Controlling Soil Vapor Extraction. *Groundwater*, v. 32, p. 239 - 247.

DiGiulio, D.C. and R. Varadhan. 2000. Steady-State Field-Scale Gas Permeability Estimation, Pore-Gas Velocity Calculation, and Streamline Generation in a Domain Open to the Atmosphere. *Remediation: The Journal of Environmental Cleanup Costs, Technologies and Techniques*, v. 10, n. 4, p. 13 - 25.

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Johnson, P.C. and R.A. Ettinger. 1994. Consideration for the Design of In Situ Vapor Extraction Systems: Radius of Influence vs. Zone of Remediation. *Ground Water Monitoring and Remediation*, v. 14, n. 3, p. 123-128.

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United States Environmental Protection Agency (USEPA). 2006. *Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice*. EPA 542-R-05-028. March. www.clu-in.org/download/remed/EPA542R05028.pdf

APPENDIX D

LINK TO ADDITIONAL RESOURCES

The following resources from the *PT&R Guidance – Remediation of Metals in Soil* are also applicable to cVOCs.

- Annotated Outline for Site Characterization Report
- Example for Bridging Memorandum
- Remedial Action Plan Sample
- Scope of Work for Corrective Measures Study
- Excavation, Disposal, and Restoration Plan Sample
- Annotated Outline for Excavation Completion Report
- Characterization Phase Workplan (Outline)
- Example for Statement of Basis
- Removal Action Workplan Sample
- Scope of Work for Interim Measures
- Transportation Plan (Outline)
- Public Participation Sample Documents

These appendices can be downloaded individually at the following location:
www.dtsc.ca.gov/SiteCleanup/PTandR.cfm

APPENDIX E
CONFIRMATION SAMPLING FOR SOIL EXCAVATIONS

Introduction

Confirmation sampling is conducted to determine whether the remedial action objectives (RAOs) for the soil excavation have been achieved. The remediation by excavation may address all or some of the following exposure pathways.

Soil Matrix RAOs. Soil matrix RAOs are developed for groundwater protection (soil leaching to groundwater pathway) and alleviation of direct contact exposure scenarios (dermal, ingestion, and particulate inhalation). Confirmatory soil matrix sampling involves the collection of samples from the floor and sidewalls of the excavation to demonstrate that contaminated soil was successfully removed.

Soil Gas RAOs. Soil gas RAOs typically are developed to alleviate vapor intrusion and outdoor air exposure. To verify that residual soil gas contamination is protective of human health, soil gas samples are collected around the perimeter of the excavation, and below the excavation footprint and/or within excavation backfill.

Confirmation sampling results can be used to support a post-remediation evaluation of risk (see Sections 6.5 and 8.8 of the main text).

Confirmation Sampling Plan

Confirmation sampling activities should be conducted in accordance with an approved confirmation sampling plan. The plan should consider the following:

- Soil gas and soil matrix samples should have the highest possible data quality objectives (DQOs).
- Statistical strategies that employ grids to facilitate the unbiased selection of sampling points should be used as appropriate. These strategies should provide a 95-percent confidence level of verifying the presence or absence of contamination.
- Flexibility to modify the sampling approach based on field observations and sampling results should be included. For example, non-statistical sampling may be used to evaluate areas where soil staining, odors, or hot spots are observed.
- Logistical considerations that may affect confirmation sampling approaches should be considered (e.g., sampling the sidewalls of a shored excavation).

The following resources may be useful in the development of the confirmation sampling plan:

- *Advisory – Active Soil Gas Investigations* (DTSC/LARWQCB, 2003)[1]

[1] Check the following link for the most current version of the document:
www.dtsc.ca.gov/SiteCleanup/Vapor_Intrusion.cfm#Vapor_Intrusion_Guidance_Documents

- *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air, Revised* (DTSC, 2005)[1]
- *Guidance Document for the Implementation of United States Environmental Protection Agency Method 5035: Methodologies for Collection, Preparation, Storage, and Preparation of Soils to be Analyzed for Volatile Organic Compounds* (DTSC, 2004)
- *Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan, EPA QA/G-5S* (USEPA, 2002)
- *Guidance on Systematic Planning Using the Data Quality Objective Process, EPA QA/G-4* (USEPA, 2006a)
- *Data Quality Assessment: A Reviewer's Guide, EPA QA/G-9R* (USEPA, 2006b)
- *Data Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S* (USEPA, 2006c)
- *SW-846 On-Line* (USEPA, SW-846 On-Line)
- *Technical and Regulatory Guidance for the Triad Approach: A New Paradigm for Environmental Project Management* (ITRC, 2003)

Additional resources are available on the USEPA and Interstate Technology and Regulatory Council (ITRC) web-sites (www.clu-in.org; www.itrcweb.org), among other sources. Attachment A of this appendix provides an annotated outline for a confirmation sampling plan.

Soil Matrix Samples

Soil matrix samples are typically collected from the floor and sidewalls of the excavation using the sampling design identified in the confirmation sampling plan. These samples should be collected in accordance with USEPA Method 5035 (DTSC, 2004). Soil matrix sampling strategies based on incremental sampling methodology (ISM) are the subject of growing interest in the field of environmental restoration. However, ISM has yet to be fully accepted by the scientific community. The ITRC is currently developing ISM guidance and provides links related resources on its web-site[2]. If ISM is being considered for a given site, DTSC should be consulted to obtain concurrence with its use in confirmation sampling.

Post-excavation soil matrix sampling should occur as soon as possible after completion of excavation activities. Soil matrix samples should not be obtained from exposed excavation surfaces. Rather, soil matrix samples should be collected approximately six to eight inches interior to the exposed surface to alleviate potential sample bias due to the volatilization of contaminants.

[2] www.itrcweb.org/teampublic_ISM.asp

Soil Gas Samples

Soil gas samples should be collected from the around the perimeter of the excavation, and within and/or below the excavation footprint to evaluate the effectiveness of the remedy on eliminating the possibility of vapor intrusion. These samples should be collected at least five feet from exposed soil surfaces to minimize the effects of atmospheric influences on sample representativeness. Soil gas samples should be collected in accordance with DTSC/LARWQCB (2003) which recommends the installation of semi-permanent soil vapor probes.

Non-excavated subsurface cVOC sources can potentially contaminate clean backfilled material through vapor transport. Hence, where excavations are above contaminated groundwater or adjacent to cVOC hot spots, soil gas monitoring will be necessary to determine if the RAOs have been achieved. The duration of the post-excavation monitoring within the backfilled material and adjacent to the excavation pit should be based upon the time needed to re-establish subsurface equilibrium. The time to reach steady-state conditions can be determined using the methods described in Johnson et al. (1999). These timeframes can be lengthy for large excavations. If these monitoring timeframes are incompatible with schedules for property redevelopment, consideration should be given to expanding the size of the proposed excavation.

References

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DTSC/ Los Angeles Regional Water Quality Control Board (LARWQCB). 2003 (revision pending). *Advisory – Active Soil Gas Investigations*. January. 10.39.0.144/lawsregspolicies/policies/SiteCleanup/upload/SMBR_ADV_activesoilgasinvst.pdf

Interstate Technology and Regulatory Council (ITRC). 2003. *Technical and Regulatory Guidance for the Triad Approach: A New Paradigm for Environmental Project Management*. December. www.itrcweb.org/Documents/SCM-1.pdf

Johnson, P.C., M.W. Kemblowski, and R.L. Johnson. 1999. Assessing the Significance of Subsurface Contaminant Vapor Migration to Enclosed Spaces: Site-Specific Alternatives to Generic Estimates. *Journal of Soil Contamination*, v. 8, no. 3, p. 389 - 421.

USEPA. 2002. *Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan, EPA QA/G-5S*. EPA/240/R-02/005. December. www.epa.gov/quality/qa_docs.html

USEPA. 2006a. *Guidance on Systematic Planning Using the Data Quality Objective Process, EPA QA/G-4*. EPA/240/B-06/001. February. www.epa.gov/quality/qa_docs.html

USEPA. 2006b. *Data Quality Assessment: A Reviewer's Guide, EPA QA/G-9R*. EPA/240/B-06/002. February. www.epa.gov/quality/qa_docs.html

USEPA. 2006c. *Data Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S*. EPA/240/B-06/003. February. www.epa.gov/quality/qa_docs.html

USEPA. SW-846 On-Line: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. http://www.epa.gov/waste/hazard/testmethods/sw846/online/index.htm

ATTACHMENT A
ANNOTATED OUTLINE
CONFIRMATION SAMPLING PLAN FOR SOIL EXCAVATIONS

Preface: The following annotated outline identifies potential content for a confirmation sampling plan. The outline is not intended to be prescriptive and should be adjusted as appropriate for site-specific conditions. Some elements identified may apply to your site, while others do not. Additional elements than are addressed by the outline may also be needed. This outline is for guidance only, and is applicable on a case-by-case basis.

1.0 INTRODUCTION

Instructions: Describe the site location, description, and history. Identify the purpose, scope and objective of the confirmation sampling. Identify the responsible agency, project organization, and responsibilities. If the confirmation sampling plan is a stand-alone document, this section should be more comprehensive.

- 1.1 Site Location, Description, and History
- 1.2 Purpose, Scope, and Objectives of Confirmation Sampling
  - 1.2.1 Demonstrate Achievement of RAOs
  - 1.2.2 Waste Characterization
- 1.3 Responsible Agency
- 1.4 Project Organization and Responsibilities

2.0 SUMMARY OF EXISTING SITE DATA

Instructions: Briefly summarize the existing site data. Identify the estimated nature and extent of contamination. Include figures, such as plume maps and geological cross sections, that support the discussion.

3.0 SUMMARY SOIL REMOVAL ACTIONS

Instructions: Describe the soil removal actions to be taken prior to confirmation sampling. Identify the RAOs, cleanup goals, and regulatory criteria. Support the discussion with appropriate figures (e.g., a figure showing the estimated vertical and lateral extent of the excavation). Describe the approach to excavation activities and confirmation sampling (e.g., sequencing of excavation, logistical considerations, confirmation sampling, laboratory turnaround time, data evaluation and decision to backfill excavation).

- 3.1 Summary of Soil Removal Objectives
  - 3.1.1 Extent of Excavation
  - 3.1.2 Waste Characterization
  - 3.1.3 [Other appropriate subsections as applicable]
- 3.2 Cleanup Goals and Regulatory Criteria
- 3.3 Role and Timing of Confirmation Sampling in the Decision Process

4.0 CONFIRMATION SAMPLE COLLECTION

Instructions: Describe the sampling design that will be used to confirm that soil excavation efforts have achieved RAOs. Provide the objectives and rationale for sample locations and frequencies. Identify considerations for the timing of sample collection relative to excavation and/or backfill activities. If applicable, describe the method for establishing a sampling grid. Identify the sampling requirements and contingencies for unexpected conditions. Provide general sample collection and preservation procedures, and analytical methods. Reference the applicable field sampling plan.

- 4.1 Sampling Objectives
- 4.2 Sampling Design and Rationale
- 4.3 Sample Locations and Depths
  - 4.3.1 Rationale for Soil Sampling
  - 4.3.2 Rationale for Soil Gas Sampling
- 4.4 Sampling Requirements
- 4.5 Sampling and Analysis
  - 4.5.1 General Sample Collection Procedures
    - 4.5.1.1 Soil Matrix
    - 4.5.1.2 Soil Gas
  - 4.5.2 Laboratory Analytical Methods
  - 4.5.3 Quality Assurance/Quality Control
- 4.6 Contingencies for Unexpected Conditions

5.0 CONFIRMATION SAMPLE COLLECTION FOR WASTE CHARACTERIZATION

Instructions: Describe the sample collection methods for characterizing excavated soil prior to disposal or reuse and to identify the need for treatment prior to disposal. Indicate the sample collection frequency and rationale. Identify the sample requirements (e.g., discrete samples, composite samples). Provide general sample collection and preservation procedures, and analytical methods. Reference the applicable field sampling plan.

- 5.1 Sampling Objectives
- 5.2 Sampling Design and Rationale
- 5.3 Sample Locations
- 5.4 Sampling Requirements
- 5.5 Sampling and Analysis
  - 5.5.1 General Sample Collection Procedures
  - 5.5.2 Laboratory Analytical Methods
  - 5.5.3 Quality Assurance/Quality Control

6.0 DATA QUALITY OBJECTIVES

Instructions: Describe the DQOs, including analytical issues (e.g., method detection limits), QA/QC limitations on data, reproducibility, accuracy and precision, and other issues related to objectives of the confirmation sampling. Reference the applicable quality assurance project plan.

7.0 DATA EVALUATION

Instructions: Describe how the data will be evaluated (1) to support the decision to continue or stop the excavation and (2) to determine appropriate disposal or reuse of excavated soil and identify any treatment requirements. Include detailed descriptions of how the cleanup goals will be applied, the statistical evaluations that will be performed, and any other methods to be used. If appropriate, include decision matrices and/or flow charts to assist with the decision process.

7.1 Determination of Adequacy of Excavation
7.2 Determine Disposal, Reuse, and Treatment Requirements for Excavated Soil

8.0 REPORT

Instructions: Describe the format and schedule for reporting the confirmation sampling and data analysis results. Include all the elements of a standard investigation report, including conclusions and recommendations based on the data and data analysis.

9.0 HEALTH AND SAFETY PLAN

Instructions: A health and safety plan for confirmation sampling activities should be included as a separate section or appendix.

10.0 REFERENCES

Instructions: List all references cited in the plan.

APPENDICES
Field Sampling Plan (FSP)*
Quality Assurance Project Plan (QAPP)*

*The confirmation sampling plan should be supported by a field sampling plan (FSP), and a quality assurance project plan (QAPP). If to be developed in conjunction with the confirmation sampling plan, annotated outlines for a generic FSP and a generic QAPP are included in Appendix A2 of the *PT&R Guidance – Remediation of Metals in Soil*[3]. Alternatively, the confirmation sampling plan can reference an existing FSP or QAPP that adequately supports the confirmation sampling activities.

[3] www.dtsc.ca.gov/SiteCleanup/upload/Appdx_A2_083108.pdf

From: Lew, Lisa (BOS)
To: Board of Supervisors, (BOS); Wong, Linda (BOS)
Subject: FW: Resolution number #21073 and 6/20/21 BOS meeting
Date: Monday, July 19, 2021 1:36:30 PM
Attachments: image001.png

For File No. 210763.

Lisa Lew
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T 415-554-7718 | F 415-554-5163
lisa.lew@sfgov.org | www.sfbos.org

(VIRTUAL APPOINTMENTS) To schedule a "virtual" meeting with me (on Microsoft Teams), please ask and I can answer your questions in real time.
Due to the current COVID-19 health emergency and the Shelter in Place Order, the Office of the Clerk of the Board is working remotely while providing complete access to the legislative process and our services.

Click here to complete a Board of Supervisors Customer Service Satisfaction form

The Legislative Research Center provides 24-hour access to Board of Supervisors legislation, and archived matters since August 1998.

Disclosures: *Personal information that is provided in communications to the Board of Supervisors is subject to disclosure under the California Public Records Act and the San Francisco Sunshine Ordinance. Personal information provided will not be redacted. Members of the public are not required to provide personal identifying information when they communicate with the Board of Supervisors and its committees. All written or oral communications that members of the public submit to the Clerk's Office regarding pending legislation or hearings will be made available to all members of the public for inspection and copying. The Clerk's Office does not redact any information from these submissions. This means that personal information—including names, phone numbers, addresses and similar information that a member of the public elects to submit to the Board and its committees—may appear on the Board of Supervisors' website or in other public documents that members of the public may inspect or copy.*

From: Isadore Rosenthal <isadore.rosenthal@gmail.com>
Sent: Monday, July 19, 2021 1:29 PM
To: Lew, Lisa (BOS) <lisa.lew@sfgov.org>
Subject: Re: Resolution number #21073 and 6/20/21 BOS meeting

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

On Mon, Jul 19, 2021, 1:20 PM Isadore Rosenthal <isadore.rosenthal@gmail.com> wrote:

> I am a Sunset resident and I OPPOSE the approval for the development loan for 2550 Irving Affordable Housing development and I OPPOSE the project as currently proposed.
> Our city and the Sunset desperately need more affordable housing but as proposed, 2550 Irving is not the solution. Here are more concerns: TOO EXPENSIVE - This proposal comes with $1 million/unit price tag and this is 60% over the average for new Affordable Housing in San

Francisco. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabilitating other buildings and building ADU's to ultimately house even more families in D4. ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving site as well the south side if 2450 Irving St. Before adding more new residents, the toxic plume on both sides need to be remediated. PARKING - I am disabled and often require a DIABLED BLUE parking space. Finding a designated BLUE PARKING space on Irving St. is already difficult, With only 11% parking ratio proposed, this will mean that the difficulty in finding parking for every Sunset resident and business, including me, will be3 compounded. A 25% parking ratio is needed.

I urge you to listen to the D4 residentsts like myself and OPPOSE this loan and this project in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St. for the benefit of new as well as existing residents and businesses.

Sincerely, Isadore Rosenthal, District 4 resident

From: Kathleen Kelley
To: Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR); Bruss, Andrea (MYR)
Subject: BOS file No. 210753 (Regarding 2550 Irving St loan)
Date: Monday, July 19, 2021 1:36:22 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Mayor, Supervisor Mar, San Francisco Supervisors, Ms. Bruss,

I urge you to vote no on the $14 Million Loan, principally because the correct process has not been followed. One of you (a supervisor) told me that when a project is in one Supervisor's District, that the other Supervisors will follow his or her lead in going forward or not.

In the Budget and Finance Committee hearing on Wednesday, July 14th, Supervisor Mar clearly told the other two supervisors that he found it problematic to recommend the loan before DTSC public comment on the remediation plan by TNDC.

Amy Chan, the finance representative from TNDC, made the egregious statement that there would be “no new information from the public comment”. In other words, Amy Chan was saying to recommend the loan, because it does not matter what the public thinks OR about the plan to remediate cancer and Parkinson-causing PCEs in the soil. The other two supervisors, in their

enthusiasm for affordable housing at any cost, disregarded Mar's request for the normal process to be followed. One of them even quoted erroneous and outdated data on the PCE levels.

If you vote to approve the loan, you will be sending a message that the public comment period in the DTSC process has no impact on political decisions. At the Budget Committee Meeting, Supervisor Mar himself knew there was something terribly wrong with this rush to circumvent the process, but when he received pressure from Supervisors Haney and Safai, Mar quickly changed his position to table the loan. Supervisor Mar should be ashamed. The facts have not changed. Each site is unique. A rush to meet the numbers is not the correct way to make decisions.

The houses along 26th Ave. and 27th Ave. 100 feet from the proposed project have an old foundations. There are cracks and penetrations where PCE soil vapor can escape from the soil and go into those houses. As yet, no one has bothered to test for PCEs in in these houses that are clearly so vulnerable. Six or more of these immediate neighbors suffer from cancer or Parkinson's disease.

How long will it take for the Supervisor Mar, the BOS, the Mayor, MOHCD, TNDC to be serious about the health of these neighbors?

It is unconscionable to pass approval on the loan until more is known on the toxins in the soil which we know are under these houses to the north of 2550. How can you sleep at night knowing that DTSC is ONLY responsible for putting a vapor barrier under 2550 and do nothing for these immediate neighbors where there is PROOF that the toxins are ALREADY present? This is your responsibility. You are aware and to vote YES will be on all your records.

Do not allow this project financing to move forward. Do the right thing. Allow due process to take place. This is not nimbyism. It is COMMON SENSE. Apply a full CEQA process to this site. Do not take shortcuts to meet a numbers count on affordable housing. WE have experts who can assist you. Allow us to assist.

I urge you to vote no on the loan to give a clear message to developers and your fellow legislators. Just because San Francisco needs affordable housing and SB35 gives you a streamlined process, does not mean you can forego the normal processes and guidelines that protect the health of San Francisco residents and the beauty and the functionality of the city itself. MOHCD needs to know that it needs a proper

market study of a piece of land, that includes the cost of removal or remediation of any toxic chemicals, before committing taxpayer dollars to a piece of land that is offered at more than twice its assessed value.

Developers and Supervisors cannot be encouraged to cut corners and claim that nothing would be different if they did things the right way.

I urge you to say to TNDC and the MOHCD to stop and allow full diligence. Do not approve this loan.

Saying that “public comment on cancer-causing chemicals would not provide any new information” is not a statement we endorse.

Thank you.

Kathleen Kelley
On behalf of myself and
The Sunset Residents Association

From:	Lew, Lisa (BOS)
To:	Board of Supervisors, (BOS); Wong, Linda (BOS)
Subject:	FW: Comment for file#210763
Date:	Monday, July 19, 2021 1:35:31 PM
Attachments:	image001.png

For File No. 210763.

Lisa Lew
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T 415-554-7718 | F 415-554-5163
lisa.lew@sfgov.org | www.sfbos.org

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From: Phoebe Kuong <kuong1628@gmail.com>
Sent: Monday, July 19, 2021 1:21 PM
To: Lew, Lisa (BOS) <lisa.lew@sfgov.org>
Subject: Comment for file#210763

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

I live in 28 ave and Layton?I oppose the 7 floor project plan by TNDC and support the 4 floor project modify plan by MSNA for 2550 Irving St project ,I concern the parking toxic density community safety unsolved issues , thanks

From:	Mike Lem
To:	Nick Stokes
Cc:	Mar, Gordon (BOS); Board of Supervisors, (BOS); Wong, Linda (BOS); Carroll, John (BOS)
Subject:	Re: Oppose the pre-development loan for 2550 Irving Street (TNDC)
Date:	Monday, July 19, 2021 1:27:09 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:-

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late ‘20s.

  Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

  Building 7 stories directly adjacent to the Sunset’s tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
  It should be right-sized to 4 stories.

  We need Design with Dignity — I can’t imagine the lack of quality of life for families living in a densified hotel development like this. There are many examples of affordable housing that offer much better choices for the families living in them. Please study them, so you can be accountable to the families who will eventually move in.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a

smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

Mike Lem
1274 28th Avenue

On Sun, Jul 18, 2021 at 11:49 PM Nick Stokes <nickjc.stokes@gmail.com> wrote:

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:-

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late '20s.

  Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

  Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
  It should be right-sized to 4 stories.

  We need Design with Dignity — I can't imagine the lack of quality of life for families living in a densified hotel development like this. There are many examples of affordable housing that offer much better choices for the families living in them. Please study them, so you can be accountable to the families who will eventually move in.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the

proposed building to at least 25%.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

Nick Stokes
1261 28th Avenue

From: Isadore Rosenthal
To: Wong, Linda (BOS)
Subject: Re: Resolution number #21073 and 6/20/21 BOS meeting
Date: Monday, July 19, 2021 1:25:48 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

On Mon, Jul 19, 2021, 1:20 PM Isadore Rosenthal <isadore.rosenthal@gmail.com> wrote:

> I am a Sunset resident and I OPPOSE the approval for the development loan for 2550 Irving Affordable Housing development and I OPPOSE the project as currently proposed.
> Our city and the Sunset desperately need more affordable housing but as proposed, 2550 Irving is not the solution. Here are more concerns: TOO EXPENSIVE - This proposal comes with $1 million/unit price tag and this is 60% over the average for new Affordable Housing in San Francisco. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabilitating other buildings and building ADU's to ultimately house even more families in D4. ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving site as well the south side if 2450 Irving St. Before adding more new residents, the toxic plume on both sides need to be remediated.
> PARKING - I am disabled and often require a DIABLED BLUE parking space. Finding a designated BLUE PARKING space on Irving St. is already difficult, With only 11% parking ratio proposed, this will mean that the difficulty in finding parking for every Sunset resident and business, including me, will be3 compounded. A 25% parking ratio is needed. I urge you to listen to the D4 residentsts like myself and OPPOSE this loan and this project in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St. for the benefit of new as well as existing residents and businesses. Sincerely,
> Isadore Rosenthal, District 4 resident

From:	Harry S. Pariser
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	Please do not extend loan to Randy Shaw!
Date:	Monday, July 19, 2021 12:36:31 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisors:

The loan to Randy Shaw for the atrocious Irving Street monolith is a bad deal for taxpayers and should be rejected.

You already know all the reasons.

Will you do the right thing?

Sincerely,

Harry S. Pariser

From:	Suzy
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Subject:	Resolution Number 210763, 7/20/21 BOS meeting
Date:	Monday, July 19, 2021 12:32:53 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor and Mayor Breed,

I am in the Sunset Neighborhood OPPOSED to the approval of 2550 Irving Affordable housing as currently proposed.

This housing is out of scale with our neighboring buildings and lacks space for all the automobiles that will need a place to park. It is an expensive project.

I propose that you spend the budget perfecting the other sites that the city has developed. The project on Haight and Stanyan needs to be completed and operational. The Navigation Center can house more instead of the tents and drug use near by. Our city desperately NEEDS REHAB and mental health services.There are drug addicts and mental health persons that need help first so you can get them off the streets. Redirect your funds for this 2550 Irving project and help them.

Please focus on keeping your residents in San Francisco. Take care of all the crime, drug use, mental health and help us feel safe again.

Sincerely,
Suzy C
28th Avenue
San Francisco District 4

From:	Martin Diky
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Peskin, Aaron (BOS)
Subject:	Resolution number #210763 oppose letter for 7/20/21 BOS meeting
Date:	Monday, July 19, 2021 12:01:49 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I OPPOSE the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.
Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

● TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s. Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high. Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants. It should be right-sized to 4 stories.

● TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

● PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

● ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

● CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

● INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation,
environmental review and cleanup and additional community engagement.
I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,
District 4 Resident, Martin Diky, 1615 30th ave san francisco CA 94122

From:	Bronwen Lemmon
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Peskin, Aaron (BOS)
Subject:	Resolution #210763 OPPOSE letter
Date:	Monday, July 19, 2021 11:28:38 AM

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Dear members and deciders of our social future,

I write to **OPPOSE the resolution** of the 2550 Irving project.

Please Vote NO

PLEASE, Bring SF voters, a project that is Environmentally and Psychologically Sustainable.

I oppose SPEED in midst of intense opposition

I oppose SKIPPING due process.

I oppose PHYSICAL and MENTAL HEALTH HAZARDs of this project.

Sincerely,
Bronwen Lemmon

Bronwen Lemmon
2111 Kirkham Street
San Francisco
CA 94122

From:	Adam Michels
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS); Breed, Mayor London (MYR)
Subject:	BOS file No.210763 , 210753. (Regarding 2550 Irving St loan)
Date:	Monday, July 19, 2021 11:25:50 AM
Attachments:	Screen Shot 2021-05-20 at 12.44.08 PM.png

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"This is a renderings created by an architect. It shows my house, my neighbors' houses, and the proposed building. It is not showing the actual design or color, but just the mass of the building."

Dear San Francisco Supervisors and Mayor Breed,

I urge you to vote no on the $14 Million Loan, principally because the correct process has not been followed. Also, we have submitted new documents to prove that the toxic remediation plan is unacceptable and that the assessment of

the land value is incorrect, because it did not account for the cost of remediation for toxic contamination.

One of you (a supervisor) told me that when a project is in one Supervisor's District, that the other Supervisors will follow his or her lead in going forward or not.

In the Budget and Finance Committee hearing on Wednesday, July 14th, Supervisor Mar clearly told the other two supervisors that he found it problematic to recommend the loan before DTSC public comment on the remediation plan by TNDC. Amy Chan, the finance representative from TNDC, made the egregious statement that there would be no new information from the public comment. In other words, Amy Chan was saying to recommend the loan, because it does not matter what the public thinks about the plan to remediate cancer and Parkinson-causing PCEs in the soil. The other two supervisors, in their blind enthusiasm for affordable housing at any cost, disregarded Mar’s plea for the normal process to be followed. One of them even quoted erroneous and outdated data on the PCE levels.

If you vote to approve the loan, you will be

sending a message that the public comment period in the DTSC process has no impact on political decisions. Supervisor Mar himself knew there was something terribly wrong with this rush to circumvent the process, and strangely said something to the effect of, "Well I guess I'm outvoted. If you can't fight 'em, join 'em" [in ignoring the process and jamming through the loan recommendation].

I live in the second house on 26th Ave. from the proposed project. I have an old foundation under my home; it is full of cracks where PCE soil vapor can escape from the soil and go into my home. Yet, no one has even bothered to test for PCEs in my home. Six or more of my immediate neighbors suffer from cancer or Parkinson's disease.

I urge you to vote no on the loan to give a clear message to developers and your fellow legislators. Just because San Francisco needs affordable housing and SB35 gives you a streamlined process, does not mean you can forego the normal processes and guidelines that protect the health of San Francisco residents and the beauty and the functionality of the city itself. MOHCD needs to know that it needs a proper

market study of a piece of land, that includes the cost of removal or remediation of any toxic chemicals, before committing taxpayer dollars to a piece of land that is offered at more than twice its assessed value.

Developers and Supervisors cannot be encouraged to cut corners and claim that nothing would be different if they did things the right way.

I urge you to say to TNDC and Supervisor Haney, “Go back and do this the right way. Saying that public comment on cancer-causing chemicals would not provide any new information is not a statement we endorse.”

Thank you.

Adam Michels
1275 26th Ave.

From: BOS Legislation, (BOS)
To: Board of Supervisors, (BOS); Wong, Linda (BOS)
Subject: FW: Resolution# 210763. OPPOSED
Date: Monday, July 19, 2021 11:19:34 AM

For File No. 210763.

Lisa Lew
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T 415-554-7718 | F 415-554-5163
lisa.lew@sfgov.org | www.sfbos.org

(VIRTUAL APPOINTMENTS) To schedule a "virtual" meeting with me (on Microsoft Teams), please ask and I can answer your questions in real time.
Due to the current COVID-19 health emergency and the Shelter in Place Order, the Office of the Clerk of the Board is working remotely while providing complete access to the legislative process and our services.
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-----Original Message-----
From: Pamela Barrango <pamelabarrango@me.com>
Sent: Monday, July 19, 2021 11:18 AM
To: Mar, Gordon (BOS) <gordon.mar@sfgov.org>
Cc: BOS Legislation, (BOS) <bos.legislation@sfgov.org>
Subject: Resolution# 210763. OPPOSED

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Gordon Mar,

I encourage you to OPPOSE this project at 2550 Irving Street, S.F. The issue of ground toxicity should be resolved for all of the people in th area before any project proceeds. Especially with regard to funding.

The size of the building proposed is a issue for all residents. The size of the building should reflect the 4 story limit here in our area.

The proposed cost is completely reflective of the governments inability to handle this project.

The last meeting I attended,(you were there) Mr. Mar. you walked out on 150 people there with similar concerns.

WHAT could have been more important than that? Your not even willing to listen, what will you do? Please pay attention to the pleas of the people whom live here.

Pamela BARRANGO
2233 Kirkham Street
San Francisco, California 94122
4153369482

Sent from my iPad

From:	june jobin
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	Resolution#210763,7/20/21BOS meeting OPPOSE
Date:	Monday, July 19, 2021 10:59:57 AM

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Dear Board of Supervisors,

As a lifelong resident of San Francisco and a 50 year resident of 27th Ave, I am writing to ask you to vote NO on the predevelopment loan for TNDC that will allow them to buy 2550 Irving Street.
I am not opposed to affordable housing in District 4 but I am opposed to proceeding without proper due diligence regarding the issued of toxic substances on and around the site.
I understand that UCSF has undertaken a study of the area regarding the public health issue derived from the site and the group of cancers and issues such as Parkinsons that may form a cluster.
With this in mind, I urge to you wait until the current remediation plan is studied more closely before a vote is taken.

Sincerely,
June Jobin
1229 27th Avenue

From:	Joan Barkan
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS)
Subject:	BOS 7/20/21 meeting, file # 210763, 2550 Irving Street Loan
Date:	Monday, July 19, 2021 10:45:37 AM

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Dear Board of Supervisors,

I'm writing to ask you to vote no on the $14M predevelopment loan that allows TNDC to buy 2550 Irving Street for 100% affordable housing. While I support affordable housing in District 4, there are many reasons this project concerns me. The key reason to vote no now is it's premature to approve the loan when DTSC has only just begun the public comment period on the draft toxic remediation plan, and we already have new information that tells us this draft plan is insufficient to keep current and new neighbors safe from PCE contamination.

I am very concerned about the health of myself and my neighbors who live just north of the site. Thank you for considering giving this remediation plan a more thorough review before a decision is made.

Sincerely,
Joan Barkan
1221 27th Avenue

From: Paul Holzman
To: Board of Supervisors, (BOS); Wong, Linda (BOS)
Subject: Re: File No. 210763, BOS meeting 7/20/21 DTSC and 2550 Irving St.
Date: Monday, July 19, 2021 9:37:54 AM
Attachments: image.png

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Subject: Re: File No. 210763, BOS meeting 7/20/21 DTSC and 2550 Irving St.

Dear Supervisor Melgar:

I am the liaison with DTSC for MSNA and have been working closely with Arthur Machado, who is managing the final decision for TNDC's draft response plan. The draft response plan was not part of the record that was considered by the Budget and Finance Committee on July 14, 2021 even though MOHCD referred to it as an "approved" plan in order to persuade the supervisors to move the loan forward to the full Board of Supervisors for a vote.

We are at the beginning of DTSC's 30-day comment phase for the draft response plan. In order to bolster their case with the Budget and Finance Committee, MOHCD's Amy Chan made the following statement to Supervisor Mar when he questioned why TNDC and MOHCD couldn't have waited (as was stipulated by the loan and purchase agreement) until DTSC's public comment period was over and the response plan approved. Ms. Chan said:

"We don't believe that there would be any new information coming from DTSC. As Jacob [Noonan] has mentioned the draft response plan has already been reviewed and preliminarily approved. And there won't be any new information coming from that process, which will conclude in mid August."

As DTSC will tell you, they do not "preliminarily approve" a draft. Additionally, by assuming there will be no new information that will come from the comment period, MOHCD and TNDC are dismissing an extremely important part of DTSC's process.

MOHCD is mistaken. There is and will be new information coming. For example, because DTSC recently saw the state of the neighbors' 100-year old crumbling foundations, they are asking the Police Credit Union (PCU) to conduct vapor intrusion testing of selected houses. This testing is done over the course of a year and will yield for DTSC much new data and a clearer idea how much toxic vapor has come into the neighbors' homes. The PCU reached out to MSNA and DTSC and we will be meeting with the PCU to discuss this later this week. This is important information for the the BOS to consider.

Based on the expert opinions of geologist Don Moore and Lenny Siegel, Executive Director of the Center for Public Environmental Oversight, it is more likely than not that the draft response plan submitted by TNDC will have to be revised after the comment period closes 8/13/21. The draft response plan is downloadable at this DTSC link: <https://nvaapp.us1-protection.com/v1/url?u=https%3A//www.envirostor.dtsc.ca.gov/public/community_involvement_documents%3Fglobal_id%3D60003063%26document_folder%3D%2B44092250898&g=ZjE1ZjA2YWNlOGI0NDOxMQ==&h=N2FlYjE3YWYtMzQwZi1kZMzUtYzdjYmJlOTQwZDM1MDEyZjQwZTBlZWVjNTY0ZWY5YjNTUlODE4MjkzMGU5MDQxMQ==&p=YXAuOnNmZHEyOmFzYWr5bhjovOmVjZDI0MzllYzA0MDFmODQ4MjIyOjAxZTdmOWU3ODk0OmVv>

The draft response plan recommends a Vapor Intrusion Mitigation System (VIMS) at a cost of $799k plus $500k for future monitoring costs. (see Draft Response Plan: p. 17; Appendix C p. 2) This is already six times the $120k cost projected by the appraisal, making the appraisal unreliable, among other reasons. However, both Mr. Moore and Mr. Siegel will testify that VIMS is inadequate for dealing with a site like the 2500 Irving Street block where the PCE plume that is under the property extends north under the adjacent homes. There is a reasonable probability that DTSC will recommend their presumptive remedy, Soil Vapor Extraction (SVE) for the contamination at Irving site. (see attached DTSC's document: Proven Technologies and Remedies Guidance: Remediation of Chlorinated Volatile Organic Compound in Vadose Zone Soil)

Both Mr. Moore and Mr. Siegel will testify that the original ESA Phase II recommendation of further neighborhood testing to discover the extent of the plumes and testing to locate the PCE hot spots should be completed before any transfer of ownership for 2550 Irving. They also will testify that with two PCE gas plumes, one of which is underneath 2550 Irving, additional vapor intrusion testing in individual neighborhood houses is necessary to determine whether PCE gas has entered other buildings besides the Police Credit Union. Mr. Moore will testify that it is not possible without further testing to estimate the total remediation cost. However, with SVE, PCE can be removed from the neighborhood without needing to conduct continued expensive monitoring for years.

If the full Board approves the resolution as submitted, even with disbursement contingent on final DTSC approval of a response plan, it is reasonably probable based on the evidence that the draft response plan will have to be revised. Revising the draft response plan will have an effect on the allocation of responsibility between the Police Credit Union whom I'm meeting with after the BOS meeting on Tuesday, and TNDC.

With this uncertainty affecting financial feasibility of the loan as submitted, it is recommended that the Board defer approval of the resolution until after the testing is completed and a response plan finalized with DTSC.

Paul Holzman
415-706-0618 cell

DEPARTMENT OF TOXIC SUBSTANCES CONTROL
CALIFORNIA ENVIRONMENTAL PROTECTION AGENCY

PROVEN TECHNOLOGIES AND REMEDIES GUIDANCE

REMEDIATION OF CHLORINATED VOLATILE ORGANIC COMPOUNDS IN VADOSE ZONE SOIL

APRIL 2010

PREFACE

The Department of Toxic Substances Control (DTSC) is issuing this Proven Technologies and Remedies (PT&R) guidance for immediate use on cleanups at hazardous waste facilities and Brownfields sites. The PT&R approach described herein is an option for expediting and encouraging the cleanup of sites with elevated concentrations of chlorinated volatile organic compounds (cVOCs) in the vadose zone. The approach is designed to ensure safe, protective cleanup and to maintain DTSC's commitment to public involvement in our decision-making process. Please see Chapters 1 through 3 for details regarding the PT&R approach and how to determine whether this guidance is suitable for a given site.

DTSC fully expects that application of the PT&R approach to cleanup of sites with cVOCs in the vadose zone will identify areas that can be improved upon as well as additional ways to streamline the PT&R cleanup process. As the protocols in this document are implemented, issues may be identified which warrant document revision. DTSC will continue to solicit comments from interested parties for a period of one year (ending April 30, 2011). At that time, DTSC will review and incorporate changes as needed.

Comments and suggestions for improvement of *Remediation of Chlorinated Volatile Organic Compounds in Vadose Zone Soil* should be submitted to:

Kate Burger
Department of Toxic Substances Control
8800 Cal Center Drive
Sacramento, California 95826
kburger@dtsc.ca.gov

ACKNOWLEDGMENTS

This document was developed by the Department of Toxic Substance Control under the direction of Mr. Maziar Movassaghi, Acting Director and Mr. Stewart Black, Acting Deputy Director of the Brownfields and Environmental Restoration Program. Without their support, completion of this guidance would not have been possible.

The preparation of this guidance was achieved through the efforts of many individuals. The following people had primary responsibility for writing:

Mr. Mark Berscheid, Hazardous Substances Engineer
Dr. Kate Burger, Sr. Engineering Geologist
Mr. Neal Hutchison, Hazardous Substances Engineer
Ms. Hortensia Muniz-Ghazi, Senior Hazardous Substances Engineer
Ms. Barbara Renzi, Associate Toxicologist
Mr. Peter Ruttan, Engineering Geologist
Mr. Stephen Sterling, Sr. Engineering Geologist

This guidance has benefited greatly through input received from several sources, including:

- DTSC's Proven Technologies and Remedies Team;
- Director's Brownfields Revitalization Advisory Group;
- Internal reviewers of draft versions of the guidance; and
- External peer reviewers of the draft guidance.

In particular, the authors wish to thank the following individuals for their thoughtful technical support throughout the development of this guidance: Dan Gallagher, Lorraine Larsen-Hallock, Janet Naito, Debbie Oudiz, and Jesus Sotelo. The authors would also like to thank the following individuals for their contributions: Tizita Bekele, Jeff Brown, Michelle Dalrymple, Mike Finch, Bruce Garbaccio, Jose Marcos, Greg Neal, Paul Pongetti, Kathaleen Reed, and Will Rowe.

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ABBREVIATIONS AND ACRONYMS

AFCEE	Air Force Center for Engineering and the Environment
ARARs	applicable or relevant and appropriate requirements
ASTM	ASTM International (formerly known as American Society of Testing and Materials)
bgs	below ground surface
Cal/EPA	California Environmental Protection Agency
Cal-OSHA	California Division of Occupational Safety and Health
CEQA	California Environmental Quality Act
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CHHSLs	California Human Health Screening Levels
CMS	Corrective Measures Study
COC	chemical of concern
CSM	conceptual site model
cVOC	chlorinated volatile organic compound
DQO	data quality objective
DTSC	Department of Toxic Substances Control
EDRP	excavation, disposal, and restoration plan
EE/CA	engineering evaluation/cost analysis
FS	Feasibility Study
HASP	health and safety plan
HSAA	Hazardous Substances Account Act
HWCL	Hazardous Waste Control Law
IC	institutional control
ITRC	Interstate Technology and Regulatory Council
LARWQCB	Los Angeles Regional Water Quality Control Board
LDR	land disposal restriction
LUC	Land Use Covenant
NCP	National Contingency Plan
NPDES	National Pollutant Discharge Elimination System
O&M	operation and maintenance

ABBREVIATIONS AND ACRONYMS (Continued)

PAH	polynuclear aromatic hydrocarbon
PCB	polychlorinated biphenyl
PCE	tetrachloroethene
PT&R	proven technologies and remedies
QA/QC	quality assurance/quality control
QAPP	quality assurance project plan
RAP	Remedial Action Plan
RAO	remedial action objective
RAW	Removal Action Workplan
RCRA	Resource Conservation and Recovery Act
RSL	USEPA Regional Screening Level
RWQCB	Regional Water Quality Control Board
SVE	soil vapor extraction
SVOC	semi-volatile organic compound
SWPPP	storm water pollution prevention plan
SWRCB	State Water Resources Control Board
TCE	trichloroethene
TPH	total petroleum hydrocarbons
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency
VOC	volatile organic compound

EXECUTIVE SUMMARY

Widely used in the United States since the 1940s, chlorinated volatile organic compounds (cVOCs) are associated with a variety of uses, such as degreasing, cleaning, manufacturing processes, and dry cleaning operations. Approximately 15 percent of projects managed by the Department of Toxic Substances Control's (DTSC's) Brownfields and Environmental Restoration Program encounter cVOCs. Table ES-1 summarizes cVOCs commonly found during these environmental cleanup projects. Typically composed of one to two carbon atoms and one to six chlorine atoms (ESTCP, 2008), the properties of cVOCs allow wide dispersal in the environment and impacts to multiple environmental media (e.g., soil, soil vapor, groundwater, indoor air). A critical pathway for health risk assessment associated with cVOCs involves the potential health risks from indoor air exposures.

Table ES-1 Commonly Encountered Chlorinated VOCs

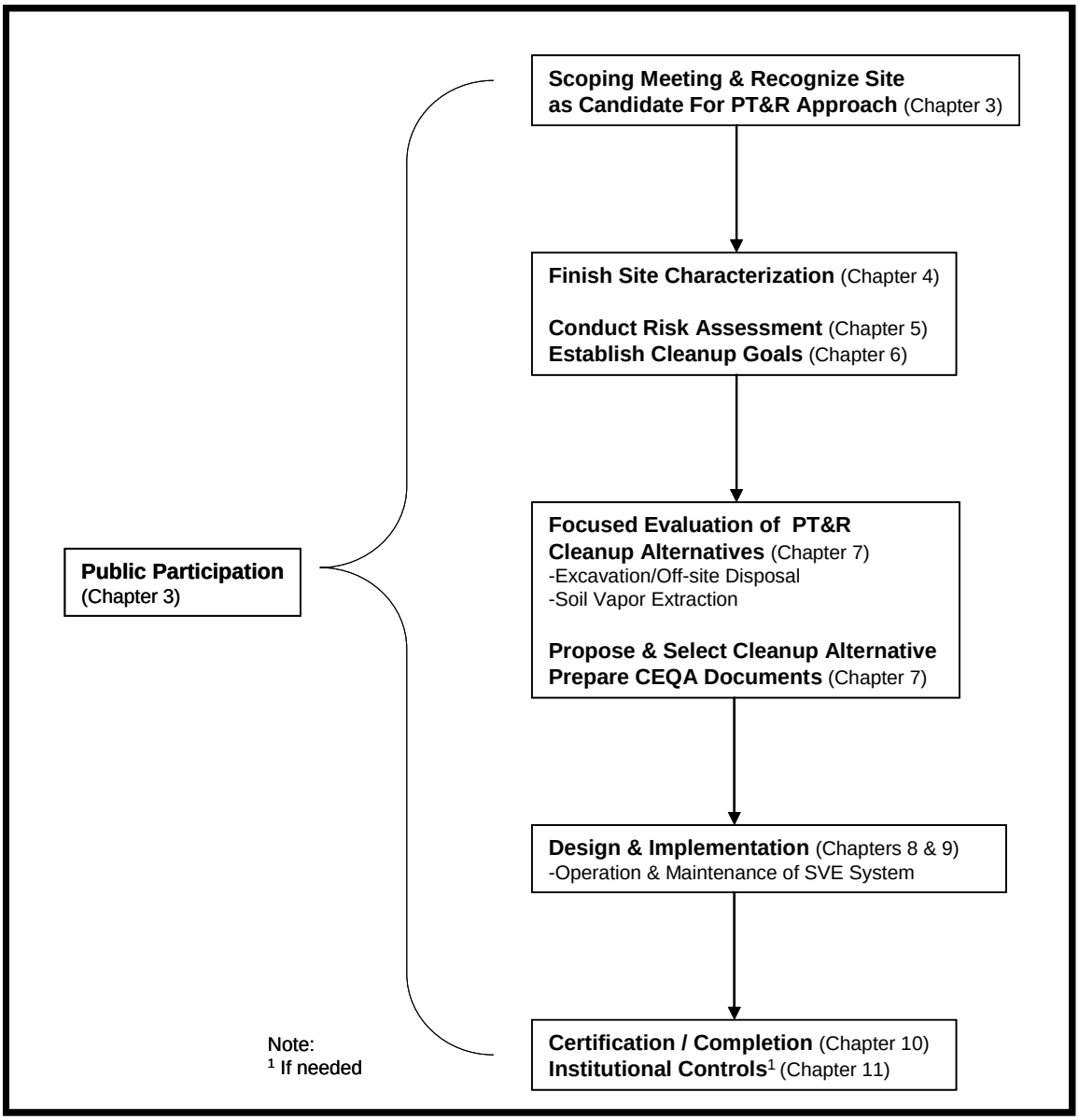
Carbon tetrachloride	1,1-Dichloroethane	1,1,2,2-Tetrachloroethane
Chlorobenzene	1,2-Dichloroethane	**Tetrachloroethylene**
Chloroethane	1,1-Dichloroethylene	**1,1,1-Trichloroethane**
Chloroform	1,2-Dichloroethylene	1,1,2-Trichloroethane
Chloromethane	1,2-Dichloropropane	**Trichloroethylene**
1,2-Dichlorobenzene	Ethylene dibromide	1,2,3-Trichloropropane
1,4-Dichlorobenzene	Methylene chloride	Vinyl chloride
Dichlorodifluoromethane	1,1,1,2-Tetrachloroethane	

Notes:
Table is not intended to be an all-inclusive list of cVOCs.
Bold indicates most commonly encountered cVOCs on DTSC cleanup projects.

DTSC has prepared this *Proven Technologies and Remedies Guidance – Remediation of Chlorinated Volatile Organic Compounds in Vadose Zone Soil* (PT&R guidance) as an option for expediting and encouraging cleanup of sites with elevated concentrations of cVOCs in vadose zone soil. The PT&R approach for cVOCs discussed herein (Figure ES-1) may be applied at operating or closing hazardous waste facilities and at Brownfields sites. This PT&R guidance can be used by any government agency, consultant, responsible party, project proponent, facility operator, and/or property owner addressing cVOCs in soil. Although expediting cleanup is emphasized, the PT&R approach is designed to ensure safe, protective remediation and to maintain DTSC's commitment to public involvement in our decision-making process.

Cleanup of contaminated sites may be governed by one or more federal or State laws, depending on such factors as the source and cause of the contamination, the type of chemical contamination found, and the type of operations conducted. The PT&R approach is consistent with these laws and will yield technically and legally adequate environmental solutions. The PT&R approach is also consistent with the U.S. Environmental Protection Agency (USEPA) presumptive remedy guidance (USEPA, 1996, 1997a).

Figure ES-1. General Overview of PT&R Approach for Sites with Vadose Zone Soils Impacted by Chlorinated VOCs.



This PT&R guidance is applicable on a case-by-case basis at sites where the remedial action objective (RAO) is to address vadose zone soils (i.e., unsaturated soils above the groundwater table) contaminated with cVOCs. The PT&R guidance will not be applicable to all sites with cVOC contamination in soil. Prior to applying this guidance to a site cleanup process, DTSC should be consulted and should concur with the use of the PT&R approach.

The results achieved through implementing the PT&R approach will depend on the site-specific RAOs which could range from removing as much cVOC mass as feasible during an interim removal action to achieving risk-based cleanup goals as part of the final remedy. The outcome of applying the PT&R approach may be the completion of an interim removal action, cleanup to levels that require on-going controls, or certification of the site for unrestricted use.

The PT&R approach (Figure ES-1) streamlines the cleanup process by (1) limiting the number of evaluated technologies to two PT&R alternatives; (2) facilitating remedy implementation; and (3) facilitating documentation and administrative processes. DTSC identified the two PT&R alternatives by conducting a study that reviewed and screened data for 90 sites throughout California where the primary contaminants were cVOCs in soil and where DTSC provided oversight of the soil cleanup. This study found that "excavation and off-site disposal" and "soil vapor extraction" (SVE) were the most frequently selected cleanup alternatives and therefore these remedies were selected as the PT&R alternatives for cVOCs in soil.

The objectives of this PT&R guidance are to:

- identify the types of sites that would be appropriate for application of the PT&R approach;
- identify the site data that should be collected to support the PT&R approach;
- provide an overview of guidance in characterizing risk and establishing cleanup goals;
- provide guidance for designing and implementing the PT&R alternatives; and
- provide sample documents, annotated outlines, and examples for the documents prepared as part of the cleanup process.

This PT&R guidance is not intended to replace the evaluation of innovative and new technologies. DTSC continues to encourage the use and evaluation of emerging technologies.

OVERVIEW OF PT&R APPROACH

Figure ES-1 and the following paragraphs summarize the steps of the PT&R approach. The PT&R approach uses the public participation process identified in the *DTSC Public Participation Policies and Procedures Manual* (DTSC, 2003).

Determine Suitability for PT&R Approach. To determine whether the PT&R approach is appropriate for a specific site, an evaluation should be conducted to determine whether the site characteristics make it amenable to the PT&R approach. Site characteristics that favor the PT&R approach are summarized in Table ES-2. Most notably, this PT&R guidance targets cleanup at sites where the primary environmental issue is cVOC contamination in vadose zone soils. Refer to Chapter 3 for details regarding these characteristics.

Table ES-2. Site Characteristics that Favor PT&R Approach

- Primarily cVOC contamination
- Ability to address any groundwater impacts through a separate remedial technology
- Soil impacts that can be addressed by excavation/disposal or SVE
- No emergency actions required
- No ecological habitat or sensitive receptors impacted[1]
- Exposure pathways and land use scenarios consistent with PT&R approach[1]

Note:
1 The approach recommended for selection of cleanup goals in this PT&R guidance considers the human health impacts of cancer risk and noncancer hazard for residential and industrial/commercial land use exposure scenarios (see Chapter 5 for details). If a site has potential impacts to ecological receptors or surface water, the PT&R approach is not applicable.

Characterization Phase. The characterization phase establishes the nature and extent of contamination in environmental media such as soil and soil gas. Under the PT&R approach, sufficient data should be collected to determine that the PT&R approach is applicable as well as to support any fate and transport modeling, risk assessment, remedy selection, and the engineering design. As data are gathered, they are evaluated to help determine whether further site characterization, risk assessment, or cleanup may be necessary.

Risk Assessment. Evaluation of potential risks to human health and the environment posed by contaminants at the site is part of the site characterization process and supports the risk management decision-making process. Depending on when a site begins using the PT&R approach, some risk assessment steps may have already been conducted and may be sufficient to support subsequent activities. A human health risk assessment is conducted to characterize potential cancer risks and noncancer health hazards. A scoping level ecological risk investigation is conducted to evaluate the potential for complete exposure pathways between ecological receptors and constituents of concern. Sites requiring further ecological assessment are beyond the scope of this PT&R guidance. The risk to groundwater quality is evaluated using measured groundwater concentrations and/or groundwater concentrations predicted by fate and transport modeling. The results of the risk assessments are used to establish appropriate site-specific RAOs and risk-based cleanup goals.

Site-Specific Evaluation and Selection of Remedial Alternatives. The remedy selection document is drafted in accordance with the requirements applicable to the site/facility. The alternative evaluation should demonstrate that the RAOs identified for the site can be met. The alternatives would generally include no action, excavation/

disposal, and/or SVE. The necessary California Environmental Quality Act (CEQA) documents may be prepared concurrently with the remedy selection document. Typically, the draft remedy selection and CEQA documents are circulated concurrently for public comment. The SVE alternative will require on-going operation and maintenance (O&M) until the RAOs are achieved, and therefore will require a regulatory oversight agreement.

Cleanup Design and Implementation. The technical and operational plans for implementing the proposed alternative may be included in the remedy selection document, if appropriate, or prepared as a separate document once a final response action is approved. Once the final response action is implemented, a report documenting its implementation is submitted to DTSC. There are several types of response action documents which may be applied to the PT&R approach, as discussed further in the main text of this PT&R guidance.

Certification / Completion. When the approved remedy for cVOCs in the vadose zone has been fully implemented, DTSC will determine through performance metrics (including confirmation sampling) whether the RAOs established in the remedy decision document have been achieved. The possible determinations are: the RAOs have been achieved; the response action has been fully implemented, is operating successfully, and on-going O&M is needed until the RAOs are achieved; and/or additional remediation is necessary. Based on these findings, DTSC will issue a certification letter, a completion letter, or a letter requiring additional work to address cVOCs in the vadose zone.

Long-term Stewardship. Long-term stewardship applies to sites and properties where management of contaminated environmental media is necessary to protect human health and the environment over time. On-going controls (such as institutional controls for contamination remaining in place) and other measures will be needed, as discussed further in Chapter 11.

1.0 INTRODUCTION

Chlorinated volatile organic compounds (cVOCs) are encountered by approximately 15 percent of cleanup projects managed by the Department of Toxic Substances Control's (DTSC's) Brownfields and Environmental Restoration Program. Widely used in the United States since the 1940s, cVOCs are associated with a variety of uses, such as degreasing, cleaning, manufacturing processes, and dry cleaning operations. These compounds are also present in some household products and automobile fluids. Releases to the environment have occurred through various mechanisms, including surface discharges, leaking underground storage tanks, and inadequate disposal practices. Unfortunately, cVOCs have properties that make them disperse widely in the environment. Their volatile nature leads to the formation of vapor plumes in soil. Small quantities of cVOCs can contaminate large volumes of water at concentrations exceeding health risk screening levels and can persist as sources of on-going contamination for long periods of time. When released as free product, cVOCs can migrate downward to significant depths (potentially hundreds of feet) and through fine grained deposits. In addition, cVOC vapors can migrate upwards to the surface and produce elevated concentrations within indoor air spaces. Potential health risks from indoor air exposures are a critical pathway for health risk assessment.

This *Proven Technologies and Remedies Guidance – Remediation of Chlorinated Volatile Organic Compounds in Vadose Zone Soil* (PT&R guidance) has been prepared to streamline the cleanup process (a generic term used to refer to corrective action and remedial action cleanup processes) at sites with vadose zone soils contaminated with cVOCs. The proven technologies and remedies (PT&R) alternatives discussed in this PT&R guidance were determined to be effective based on:

- engineering and scientific analysis of performance data from past State and federal cleanups and
- review of the administrative records and procedures used to implement the technologies.

This PT&R guidance is one of three documents developed under DTSC's PT&R efforts that outline an option for streamlining the cleanup process, thus increasing the number of acres that are cleaned up and returned to beneficial use. Analogous documents pertaining to metals and organochlorine pesticides in soil can be obtained from the DTSC Web-site (www.dtsc.ca.gov/SiteCleanup/PTandR.cfm). The PT&R approach described herein can be applied to operating or closing hazardous waste facilities and to Brownfields sites. Although expediting the cleanup process is emphasized, the PT&R approach is designed to ensure safe and protective remediation.

1.1 PURPOSE AND OBJECTIVE

The purpose of this PT&R guidance is to encourage and support the use of DTSC's experience and to provide guidance on PT&Rs for expedited cleanup of sites with cVOCs in vadose zone soil. The PT&R guidance is intended for use by any government agency, consultant, responsible party and/or property owner addressing

potential cVOC contamination at a site. Prior to applying this PT&R guidance to a site cleanup process, the oversight agency must be consulted and must concur with use of the PT&R approach.

The objectives of the PT&R guidance are to:

- identify the characteristics that make a site conducive for application of the PT&R approach for cVOCs;
- provide recommendations for characterizing the nature and extent of contamination and collecting data needed to support the cleanup alternative evaluation;
- summarize guidance for characterizing risk and establishing cleanup goals;
- focus the site-specific evaluation of cleanup alternatives to the PT&R alternatives;
- provide guidance for post-cleanup evaluation to characterize the residual cVOC concentrations; and
- provide guidance on associated administrative requirements, such as documentation and implementation of the cleanup alternative selection process.

As discussed further in Section 1.3, the degree of cleanup achieved through implementing the PT&R approach will depend on the site-specific remedial action objectives (RAOs). Possible results of implementing the PT&R approach could include mass removal to the extent feasible, cleanup to levels requiring on-going controls, or cleanup to levels allowing unrestricted use.

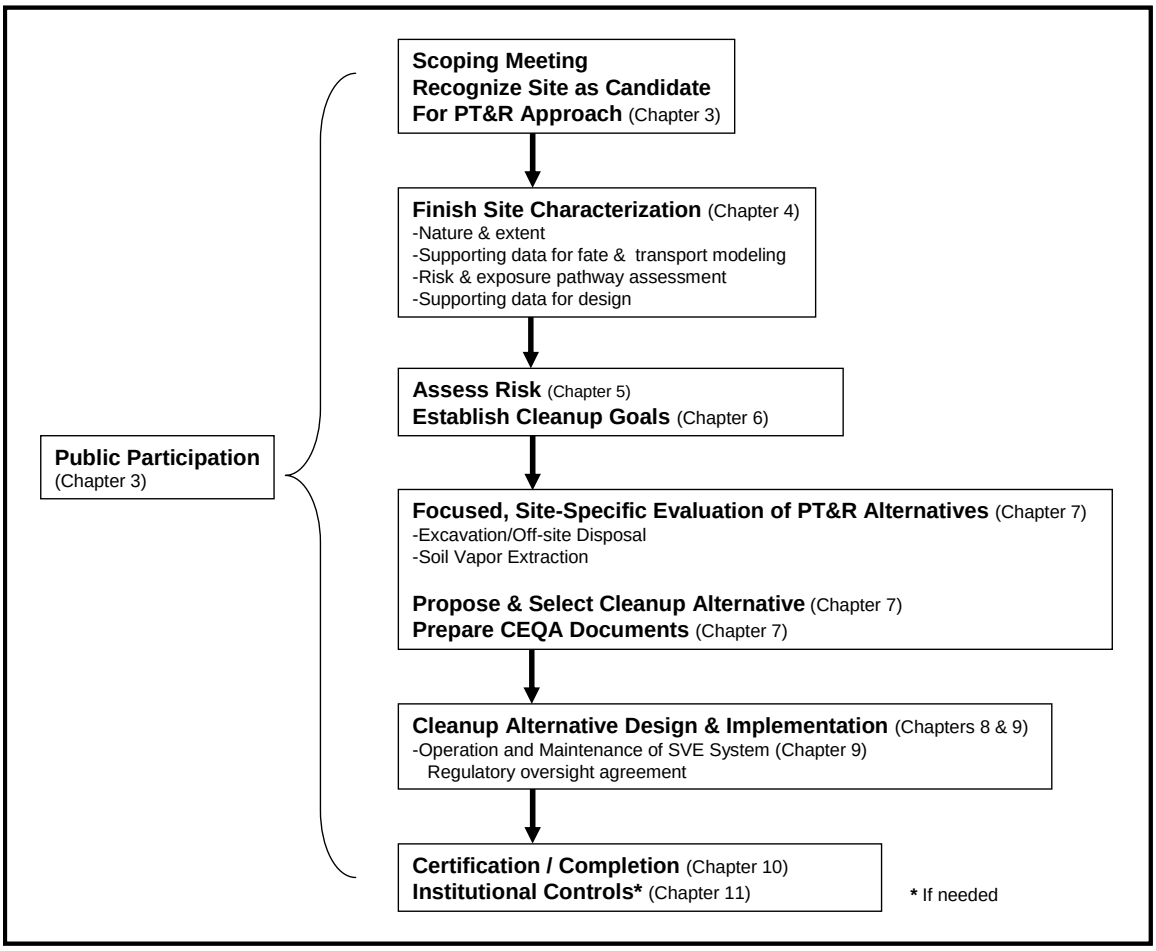
As illustrated in Figure 1, the PT&R approach follows typical steps used by standard cleanup processes. Because sites can begin applying the PT&R approach at various stages in the cleanup process, some topics discussed in this PT&R guidance may not be applicable to a given site. For example, risk characterization completed prior to initiating the PT&R approach could be used to support subsequent steps of the cleanup process. If risk characterization has not previously been conducted prior to using the PT&R approach, the approach described in Chapter 5 can be used to characterize the risk.

1.2 TECHNICAL BASIS FOR PT&R APPROACH AT SITES WITH VADOSE ZONE SOIL CONTAMINATED WITH CHLORINATED VOCs

DTSC conducted a study that reviewed and screened data for 90 sites where the primary contaminants were cVOCs in vadose zone soils (see Section 7.1 for details). The study identified the technologies that were consistently evaluated and technologies that were subsequently selected as the remedy. The results of the DTSC study revealed that “excavation and offsite disposal” (excavation/disposal) and/or “soil vapor extraction” (SVE) were the most frequently selected cleanup alternatives. Hence, excavation/disposal and SVE were selected as the PT&R alternatives for cVOCs in vadose zone soil.

The study also revealed that most sites had cVOC impacts to both vadose zone soil and groundwater. This typically resulted in selection of excavation/disposal and/or SVE to address the soil impacts and selection of another remedy to address the groundwater plume. Because groundwater cleanup times can be considerably longer than times for soil cleanups, the soil cleanup action was often implemented as an interim removal action to quickly address cVOC mass posing an on-going threat to groundwater.

Figure 1. PT&R Approach for Sites With Chlorinated VOCs in Vadose Zone Soil.



1.3 SCOPE AND APPLICABILITY

This PT&R guidance is designed to assist with the cleanup of cVOCs in vadose zone soil. The results achieved will depend on the site-specific RAOs and the overall purpose of implementing the PT&R approach (e.g., interim removal action, final remedy). A RAO could consist of removing as much cVOC mass as feasible during an interim removal action (such as to decrease the amount of cVOC mass migrating

toward groundwater). When implemented as the final remedy, RAOs may establish risk-based cleanup goals to be achieved by the removal action. As applicable, the PT&R approach should be coordinated with the groundwater remedy so that cVOCs in groundwater do not recontaminate vadose zone soils and vice versa. The outcome of applying the PT&R approach may be the completion of feasible mass removal, cleanup to levels that require on-going controls, or certification of the site for unrestricted use.

As discussed further in Section 3.2, this guidance is intended for sites that meet the following conditions:

- cVOCs are the primary contaminant of concern;
- no emergency or time-critical removal actions required;
- cVOC impacts to unsaturated soil can be addressed by excavation/disposal and/or SVE;
- groundwater impacts can be addressed by a separate remedial technology; and
- exposure pathways, receptors (human health), and land use scenarios (residential, industrial/commercial) applicable to the site are consistent with the PT&R approach (see Chapter 5 for details).

The PT&R approach is not applicable to all sites with cVOC impacts to soil. As discussed further in Section 3.3, the PT&R approach for cVOCs may not be appropriate for sites with:

- mixtures of contaminants (e.g., more complex treatment may be required);
- shallow bedrock;
- ecological habitat or sensitive receptors; and
- surface water features.

If any of these conditions are present, this PT&R guidance may not be appropriate for the site and a more extensive cleanup technology evaluation should be conducted.

DTSC continues to encourage the use and evaluation of emerging technologies and therefore this PT&R guidance is not intended to replace evaluation of innovative and new technologies.

2.0 OVERVIEW AND ORGANIZATION

Cleanup of contaminated sites may be governed by one of several federal or State laws, including the:

- Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)
- Resource Conservation and Recovery Act (RCRA)
- Hazardous Waste Control Law (HWCL)
- Hazardous Substances Account Act (HSAA)

The law applicable to a given site depends on such factors as the source, cause of the release, and cleanup process under which the site is being addressed. The PT&R approach operates consistently with these laws and will yield technically and legally adequate environmental solutions. Any procedural differences between cleanup authorities will not substantively affect the outcome of the cleanup. The remedies evaluated and selected must be: (1) protective of human health and the environment; (2) able to achieve RAOs and cleanup goals; and (3) able to control or remediate sources of releases.

The PT&R approach (Figure 1) is consistent with DTSC's conventional cleanup processes through which sites undergo:

- site characterization (also referred to as site investigation);
- risk assessment;
- remedy screening and evaluation, such as under a Feasibility Study (FS) or Corrective Measures Study (CMS);
- remedy selection; and
- implementation of the corrective action and/or remedial action.

The PT&R approach streamlines the remedy screening, evaluation, and selection phases. In addition to being used as guidance for selecting the final remedy for a site, the PT&R approach is also suitable for interim removal actions to prevent or minimize the spread of contamination while final cleanup action alternatives are being evaluated. Because the PT&R guidance identifies excavation/disposal and SVE as the preferred alternatives, the data needed to support the remedy selection phase are potentially focused and reduced, thus decreasing time and investigation costs.

The use of the guidance document may have the following benefits:

- **Time and cost savings**. The guidance streamlines the cleanup process by (1) limiting the number of evaluated technologies; (2) facilitating corrective action and/or remedial action implementation by providing samples and annotated outlines for key documents; and (3) facilitating documentation and administrative processes.

- **Focused site characterization to support cleanup design**. Data needed to support the cleanup design is collected during site characterization activities. Preferably, the PT&R approach should be initiated as early as possible in the assessment and/or characterization phase.

- **Focused remedy selection**. The evaluation of cleanup alternatives is focused on the two most commonly implemented alternatives.

- **Transparent process**. Stakeholders are identified and involved early and throughout the cleanup process.

The PT&R guidance is organized into twelve chapters:

Chapter 1 presents introductory information, including the purpose, objective, scope, and applicability of the PT&R guidance.

Chapter 2 provides an overview of the PT&R approach and summarizes the organization of the PT&R guidance.

Chapter 3 summarizes the site assessment to determine its suitability for the PT&R approach. Community assessment is also discussed.

Chapter 4 identifies site characterization objectives and identifies key reference materials for characterization activities.

Chapter 5 summarizes risk assessment approaches.

Chapter 6 describes the development of cleanup goals, risk management considerations, evaluation of short-term risks during remedy implementation, and post-cleanup risk evaluation.

Chapter 7 summarizes and documents the DTSC study that is the basis for the PT&R alternatives. This chapter also addresses the focused evaluation and selection of the cleanup alternative.

Chapter 8 summarizes the design and implementation considerations for the excavation/disposal alternative.

Chapter 9 summarizes the design and implementation considerations for the SVE alternative.

Chapter 10 addresses the completion or certification of the remedy for cVOCs in the vadose zone.

Chapter 11 discusses long-term stewardship considerations.

Chapter 12 provides the references cited in this guidance document.

3.0 SITE ASSESSMENT

The PT&R approach is initiated by assessing whether this guidance may be applied to a given site with cVOCs in vadose zone soil. As discussed in Section 3.1, the decision to apply the PT&R approach can be made in a project scoping meeting between DTSC and project proponents. A potential outcome of the scoping meeting might be that the PT&R approach is not appropriate for the site and that standard DTSC cleanup processes should be implemented.

Because it was not realistic to develop a guidance document that addresses every possible site scenario, Sections 3.2 and 3.3 identify favorable site characteristics and potential limitations for applying the PT&R approach. The presence of limitations does not necessarily preclude use of the PT&R approach. If limitations are identified, DTSC and project proponents would make a determination as to whether it is appropriate and worthwhile to apply the PT&R approach with site-specific adjustments.

3.1 PROJECT SCOPING

The project scoping objectives under the PT&R approach are the same objectives that are used under any DTSC cleanup process. These objectives include:

- establishing a management approach for the project;
- developing a site cleanup strategy which is protective of human health and the environment;
- developing a project plan (i.e., the step-by-step strategy to be used for the site cleanup);
- recognizing unique site conditions to be addressed during the cleanup process (e.g., cultural resources, sensitive human receptors);
- identifying and assessing stakeholders; and
- scoping public participation activities.

3.1.1 Scoping Meetings

DTSC staff and project proponents should hold one or more project scoping meetings. Typical discussion topics during these meetings include:

- site background, physical setting, current/past land uses, and unique site characteristics;
- status of site investigation and cleanup;
- conceptual site model (CSM; i.e., types and locations of releases, affected environmental media [e.g., soil, soil vapor, groundwater, indoor air], contaminant migration pathways, current and potential future receptors, exposure pathways [e.g., direct contact, inhalation, vapor intrusion into indoor air, drinking water], potential risks);

- regulatory framework for site cleanup;
- initial scope of work for completing site characterization, filling data gaps, and cleaning up the site;
- potentially applicable remedial technologies;
- preliminary identification of response actions and the implications of these actions (e.g., restricted land use, long-term stewardship);
- preliminary RAOs and cleanup goals;
- project planning, phasing, scheduling, and priorities; and
- stakeholder identification and public participation activities.

The scoping meeting would determine if the PT&R approach may be applied to all or part of the site cleanup, either as described in this PT&R guidance document or with site-specific adjustments (see Section 3.4). If the PT&R guidance is appropriate, the intended outcome of implementing the PT&R approach (e.g., mass removal, unrestricted use) and any long-term stewardship requirements associated with the contemplated cleanup approach should be addressed. If applicable, the scoping meeting should address how the PT&R approach for cVOCs in vadose zone soil will be coordinated with the groundwater remedy and/or vapor intrusion mitigation measures.

The outcome of the scoping meeting(s) may be summarized in a scoping document that includes:

- analysis and summary of site background and physical setting;
- summary of previous response actions, including all existing data;
- presentation of the CSM, human health risks, and data gaps;
- scope and objectives of remaining characterization and risk assessment activities;
- scope and objectives of the site cleanup;
- RAOs and cleanup goals;
- preliminary identification of possible response actions and data needed to support the evaluation of cleanup alternatives; and
- initial presentation of site remedial strategies (e.g., decision to apply the PT&R approach, coordination between PT&R approach and groundwater remedy).

3.1.2 Stakeholder Identification and Assessment

Stakeholder involvement is considered essential for the success of any cleanup action. At the onset of the proposed project, stakeholders should be identified and contacted for input. Stakeholders include any individuals, government organizations, environmental and other public interest groups, academic institutions, and businesses with an interest in the project. The identification of stakeholders is largely based on those entities or individuals who are already involved in the project, and contacting others with related

interests or those who may be in close proximity to the site. Stakeholders provide information on the preferences of the community and may also identify unaddressed issues. Early identification of stakeholders is necessary to ensure effective and timely participation to meet stakeholder expectations, and to improve the decision-making process.

3.1.3 Public Participation Activities

The PT&R approach acknowledges the importance of early community outreach and uses the public participation process identified in the *DTSC Public Participation Policies and Procedures Manual* (DTSC, 2003). The manual addresses public participation components of the cleanup process and compliance with State and federal laws and regulations. Summaries of the public participation elements for each DTSC program, California Environmental Quality Act (CEQA), and various public outreach activities are included. Also provided are checklists and recommended content for the public participation plan, fact sheets, public notices, and other public outreach activities. A link to sample public participation documents is provided in Appendix D.

The vapor intrusion pathway may be a concern for some cVOC sites. The public participation process should begin as soon as it is determined that cVOCs are present and a vapor intrusion evaluation is necessary. The *Vapor Intrusion Mitigation Advisory* (DTSC, 2009a) outlines public participation considerations for sites with vapor intrusion issues.

3.2 SITE CHARACTERISTICS THAT FAVOR THE PT&R APPROACH

This PT&R guidance is intended for remediation at sites where the primary environmental issue is cVOCs in vadose zone soil. The site characteristics summarized in Table 1 favor application of the PT&R approach.

3.3 SITE CHARACTERISTICS THAT MAY LIMIT THE USE OF THE PT&R APPROACH

Table 2 summarizes site conditions that may limit application of the PT&R approach. Additional rationale for the limiting characteristics is provided in the following paragraphs. Some of the limiting characteristics described below may not be applicable if the PT&R approach is being used as an interim removal action.

3.3.1 General Characteristics

Time-Critical Cleanup/Emergency Response Actions. The approach used for time-critical cleanup or emergency response actions (i.e., removal actions that are imminent and must be carried out immediately) will be more streamlined than the PT&R approach and will be subject to different regulatory requirements than non-time critical cleanup actions.

Potential Ecological Risk. Sites located in areas that are designated as environmentally sensitive (e.g., wetland areas, wildlife refuges, endangered species habitat), or that have other characteristics that suggest potential ecological impacts, are not candidates for the PT&R approach. Ecological risks may be present at sites where potential habitat, ecological receptors, surface water drainages, and/or surface water features are present. Because the cleanup process may be more complex (including the development of appropriate cleanup goals and potential ecological impacts by implementation of the remedy), these types of sites may not be suitable for the PT&R approach.

Surface Water Features. Sites with surface water may not be suitable for the PT&R approach. Surface water and associated zones of water saturation introduce variability and uncertainty in the distribution, migration, and concentration of cVOCs in soil and soil gas, and complicate the design and implementation of remedies. Also, surface water potentially impacted by runoff or subsurface migration of cVOCs from contaminated soil may be linked to ecological risk or have other risk considerations. The cleanup goals and alternatives recommended by this guidance document do not consider these risks.

Complex Sites. The PT&R approach may not be appropriate for complex sites that require a more elaborate cleanup strategy than is offered by this approach. Large sites may require integration of multiple cleanup approaches and may need to consider ecological risk when selecting the cleanup alternative. Sites with off-site contamination or potential off-site receptors require an evaluation beyond the scope of the PT&R approach.

Table 1. Site Characteristics that Favor the PT&R Approach

Applicable PT&R Alternative(s)	Favorable Characteristic	Primary Rationale for Favorable Characteristic
• Excavation/disposal • SVE	cVOC contamination	• PT&R alternatives are most common remedies used to address cVOCs in vadose zone.
	No emergency actions required	• PT&R approach requires a planning period of at least six months.
	Industrial/commercial or residential land use scenario	• Residential and industrial/commercial exposure scenarios are the most common scenarios evaluated. Standard default assumptions are available.
	Human receptors only	• This guidance addresses health risk cleanup goals for human receptors.
	Groundwater impacts addressed by a separate remedy	• The PT&R alternatives do not directly address groundwater.
• Excavation/disposal	Readily accessible contamination	• Can be the most efficient means of removing impacts to shallow soils. Feasible depth for excavation is a site-specific decision.
	Co-located contaminants	• Likely more feasible if the same excavation activities would remove cVOCs as well as other contaminant types.
• SVE	Conditions conducive to effective SVE	• Conditions for effective SVE: homogeneous, permeable soils; adequate vadose zone thickness; volatile contaminants.

Table 2. Site Characteristics that Limit the PT&R Approach

Applicable PT&R Alternative(s)	Limiting Characteristic	Primary Rationale for Limiting Characteristic
• Excavation/ disposal • SVE	Multiple contaminant groups	• Multiple contaminant groups may be more efficiently cleaned up by alternate approaches.
	Emergency action required	• These actions have different regulatory requirements and require a faster response than can be achieved under the PT&R approach.
	Ecological habitat or sensitive receptors	• If the scoping-level ecological investigation identifies potentially complete exposure pathways, further assessment is necessary and is beyond the scope of this PT&R guidance.
	Potential for surface water impact	• Impacts to surface water may have associated ecological risks. The risk assessment approach recommended by this guidance addresses human health risk only.
	Land use or exposure scenario other than residential or industrial/commercial	• Other land use or exposure scenarios require site-specific evaluation and an adjustment to the PT&R approach. Default exposure assumptions generally are not available.
	Off-site contamination and potential receptors	• Adds complexity to the cleanup process and the evaluation of receptors. Requires an evaluation beyond the scope of this guidance.
• Excavation/ disposal	cVOC impacted soil cannot be excavated	• Excavation is only feasible up to certain depths (based on site-specific considerations). • Site infrastructure or conditions may preclude excavation.
	Multiple contaminant groups	• Multiple contaminant groups may limit disposal options. Multiple excavations required if contaminants are not co-located.
• SVE	Soils with low air permeability	• Fine-grained or high moisture content soils require a higher vacuum and typically require a longer remediation time, which increase the cost of SVE. SVE is not technically feasible in soil with very low permeability where sufficient air flow rates (pore gas velocity) cannot be created.
	Shallow groundwater	• Sites with shallow groundwater may be better addressed via the groundwater remedy.
	cVOC contamination near capillary fringe	• High moisture conditions near the capillary fringe decrease mass removal via SVE.
	Saturated soil	• SVE is not effective under saturated conditions.
	Heterogeneous soil	• Heterogeneity results in lower mass removal rates and prolongs operation time for the SVE system.
	Bedrock	• This guidance does not address SVE in bedrock.
	High soil organic matter content	• cVOCs sorb to soil organic matter, decreasing the mass removal rates and prolonging the operation time for the SVE system.
	Multiple volatile contaminant groups	• Other treatment options may be needed for multiple types of volatile contaminants.
	Non-volatile contaminants	• SVE is more effective for volatile compounds.

3.3.2 Excavation/Disposal

Inaccessible Soil Impacts. Soil impacted with cVOCs may not be accessible by excavation. Each site will have a maximum depth that is feasible for excavation. Some soil impacts may not be accessible because of buildings or other infrastructure. Excavation may be logistically infeasible because of adverse effects on site operations or activities.

Multiple Contaminant Groups. Excavation/disposal may not be suitable for sites that have a mixture of cVOCs and other contaminants and that may be more effectively or efficiently cleaned up by other approaches (such as when the contaminants are not co-located). Additional types of contaminants may affect soil disposal options.

3.3.3 Soil Vapor Extraction

Multiple Contaminant Groups. Mixtures of volatile contaminants generally require more complex SVE treatment systems (e.g., multiple treatments) than are described in Chapter 9. Contaminant matrices, such as high concentrations of oil and grease, pose additional complexities. Non-volatile contaminants cannot be addressed by SVE and would require a separate remedy.

Soil Properties. Low permeability, high soil organic matter content, and heterogeneous soils will have lower mass removal efficiencies. This guidance is not applicable for sites where SVE is being implemented to address cVOCs in bedrock.

Moisture Content. SVE is not effective in saturated soils. Low soil permeability is observed with higher soil moisture content, resulting in decreased mass removal efficiencies. SVE may not be effective in removing cVOC mass near the capillary fringe.

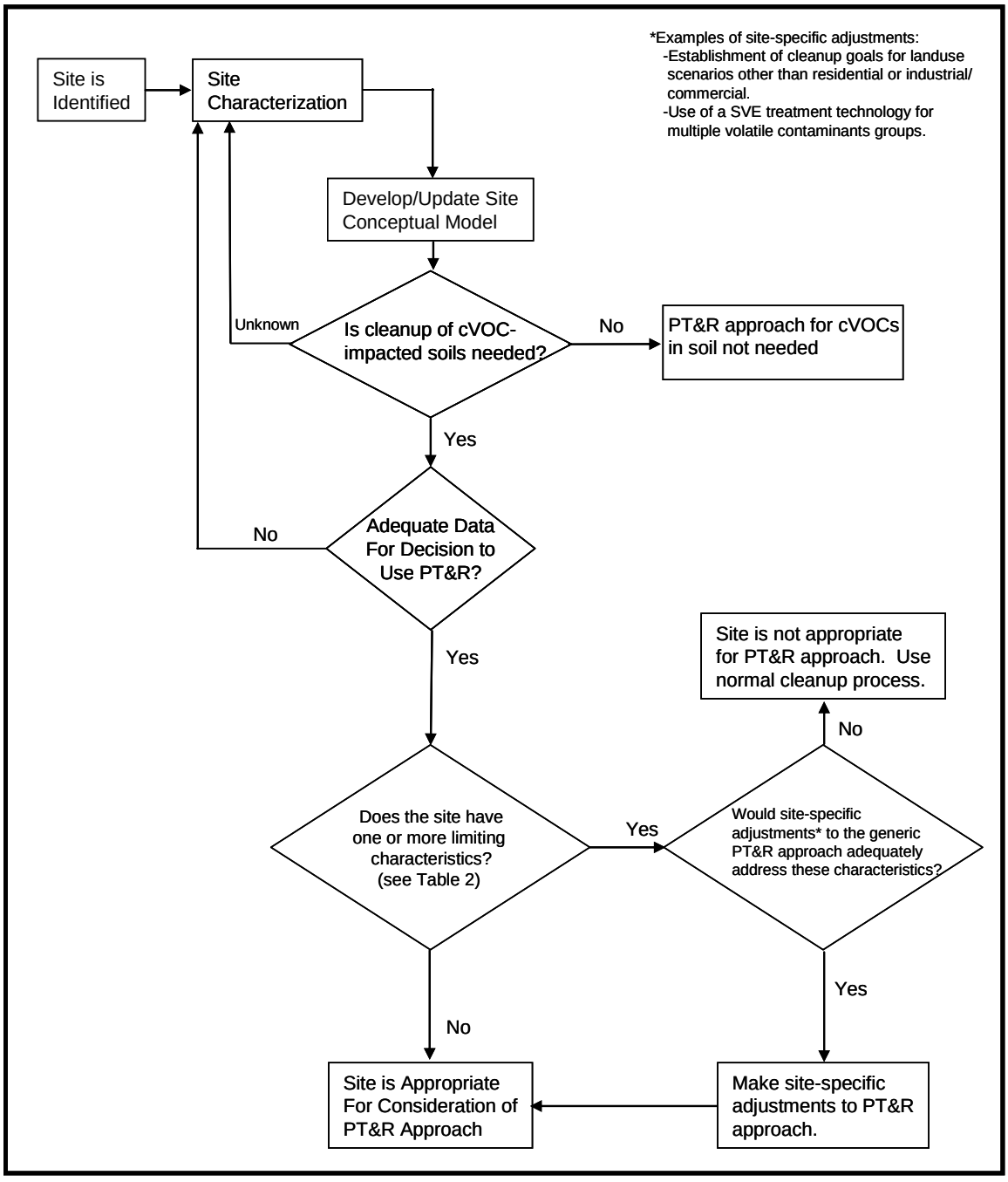
Shallow Groundwater. SVE is typically implemented at sites having sufficient vadose zone thickness to warrant its use. Sites with shallow groundwater may have high soil moisture content in the vadose zone or cVOCs contacting the capillary fringe, both conditions lead to inefficient removal of cVOCs by SVE. At sites with shallow groundwater, one option is to use excavation/disposal to address accessible cVOC-impacted soils and other remedial approaches to address the remaining cVOC mass in the subsurface.

3.4 DETERMINATION OF SUITABILITY FOR PT&R APPROACH

Figure 2 summarizes the recommended process for determining the suitability of the PT&R approach at a site. While a decision to apply the PT&R approach can be made at any point in the cleanup process, a site can be evaluated for suitability under the PT&R approach as soon as information is available that indicates a response action is necessary.

A CSM should be developed to assist with the determination of suitability for the PT&R approach. The CSM is intended to summarize all currently available information about the site, develop a preliminary understanding of the site, and identify data gaps. Appendix A provides the CSM for cVOCs in the subsurface. The identified data gaps should be used to determine whether sufficient information is available to make a decision that a site is suitable for the PT&R approach.

Figure 2. Process for Determining if the PT&R Approach for Chlorinated VOCs in Vadose Zone Soil is Appropriate for a Given Site



4.0 SITE CHARACTERIZATION

The primary objective of the characterization phase is to establish the nature, extent, and distribution of cVOC contamination (Section 4.1). Under the PT&R approach, another objective of the characterization effort is to collect the data needed to support any fate and transport modeling efforts (Section 4.2), and to support the engineering design (Section 4.3). Site characterization activities should be conducted in accordance with a DTSC-approved workplan, including a field sampling plan and a quality assurance project plan (QAPP). Appendix D includes a link to annotated outlines for a characterization phase workplan and a site characterization report.

The site characterization efforts should be designed to produce effective, decision quality data in a manner that is cost effective and timely. The Triad approach to data collection, described in the *Technical and Regulatory Guidance for the Triad Approach: A New Paradigm for Environmental Project Management* (ITRC, 2003), should be considered for sites using the PT&R approach. The *Standard Practice for Expedited Site Characterization of Vadose Zone and Ground Water Contamination at Hazardous Waste Contaminated Sites* (ASTM, 2004) may also be useful. The approaches described in these guidances can focus work towards rapid site characterization decisions. Additional information about the Triad approach can be found at the following link: www.triadcentral.org.

Low-cost passive or real-time measurement technologies (such as passive soil gas sampling, membrane interface probes, grab groundwater sampling) may be useful techniques for characterizing sites with cVOC impacts. These techniques allow for data collection programs covering wider areal or vertical extent over shorter time frames than can be achieved by traditional methods. The techniques can then be followed by higher quality data collection methods (i.e., active soil gas sampling, permanent vapor monitoring well installation, permanent groundwater monitoring well installation) to characterize the site, support the risk assessment, and the remedy design.

The characterization phase should culminate with an updated CSM and an analysis to ensure that the PT&R approach is still applicable (see Chapter 3). Appendix A presents the CSM for cVOCs in the subsurface.

4.1 SOIL, SOIL GAS, AND GROUNDWATER

This section provides brief discussions of investigation strategies and available resources for investigating soil, soil gas, and groundwater. Because numerous guidance documents are available to assist with the design and implementation of site investigations, this guidance does not include an extensive discussion of site characterization.

Soil Gas. Soil gas investigations are useful to obtain vapor phase data at sites potentially affected by volatile contaminants. Both passive and active soil gas data can be useful for site characterization. Where practicable, soil gas sampling is preferred over soil matrix and groundwater sampling for assessing cVOC impacts, including

characterization objectives such as source identification, determining spatial distribution, and assessing potential vapor intrusion risks. Soil gas sampling should consider the *Advisory – Active Soil Gas Investigation* (DTSC and LARWQCB, 2003; revision pending). Please check the DTSC web-site at the following link for updated versions of this advisory: www.dtsc.ca.gov/SiteCleanup/Vapor_Intrusion.cfm.

Soil Matrix. Soil matrix data provide the total cVOC concentration in subsurface soil which may be useful for defining the source location and high concentrations of cVOCs. In addition, soil matrix data are used to evaluate risks associated with direct contact exposure pathways for cVOCs in soil, such as the dermal contact, ingestion, and outdoor-air inhalation pathways. Soil matrix samples should be collected using the procedures described in the *Guidance Document for the Implementation of United States Environmental Protection Agency Method 5035: Methodologies for Collection, Preparation, Storage, and Preparation of Soils to be Analyzed for Volatile Organic Compounds* (DTSC, 2004).

Groundwater. Impacts to groundwater are often observed at sites with cVOC impacts to vadose zone soil and therefore should be evaluated as part of the site characterization activities. The California Environmental Protection Agency (Cal/EPA) has several guidance manuals for groundwater investigations (Cal/EPA, 1995) that can be used to characterize groundwater. In addition, resources included on the U.S. Environmental Protection Agency (USEPA; www.clu-in.org), Interstate Technology and Regulatory Council (ITRC; www.itrcweb.org), and ASTM International (ASTM; www.astm.org) websites may be useful.

4.2 DATA NEEDED TO SUPPORT MODELING EFFORTS

Fate and transport modeling is often used during the characterization phase for the purpose of evaluating the movement of cVOCs in the vadose zone, assessing the potential for cVOC migration to groundwater, developing soil cleanup goals for protection of groundwater, and estimating the potential risk posed by vapor intrusion into indoor air. Therefore, in addition to delineating concentrations of cVOCs in various environmental media (Section 4.1), site characterization should include sampling for site-specific soil properties to support these modeling efforts. For example, a site-specific screening analysis of the risk posed by the vapor intrusion pathway may require information regarding site stratigraphy and building parameters in addition to the following soil properties: bulk density, grain density, total porosity, grain size distribution, moisture content, fraction of organic carbon, and air permeability (DTSC, 2005a; revision pending). Other fate and transport models may require additional site-specific parameters, such as hydraulic conductivity, estimated recharge or infiltration rates, biodegradation rates, and chemical retardation factors. The input parameter requirements for the models anticipated for use at a site should be considered during workplan development.

4.3 DATA NEEDED TO SUPPORT DESIGN OF PT&R ALTERNATIVES

Under the PT&R approach, an objective of the characterization phase is to collect data needed to support the design process. Sufficient data should be collected to eliminate or minimize the need for additional field mobilizations during the site-specific remedy evaluation or design phases.

4.3.1 Excavation/Disposal

Data needed for design of the excavation can be collected with other site investigation activities. As applicable to a given site, the following data is necessary to adequately address the excavation limits and design:

- vertical and horizontal distribution of contaminants (i.e., areal extent of impacted soil and soil gas, depth of impact) and volume of soils to be excavated;
- identification of soil conditions that affect the selection of excavation equipment;
- depth to groundwater;
- climatology/seasonal variations (e.g., months with higher likelihood of rainfall events or higher groundwater table);
- survey map of site features (e.g., topography, existing structures, utilities, wells, surface water control measures, property boundaries);
- geotechnical data for each soil type (i.e., soil classification, Atterberg limits, moisture content, bulk density);
- structural contour map of the top of competent bedrock; and
- waste characterization (to support identification of applicable disposal options).

4.3.2 Soil Vapor Extraction

The data collected should be sufficient to identify the feasibility of SVE, to design a pilot-scale test (if needed), and to begin designing the SVE system. At a minimum, the following data should be collected in conjunction with the site characterization activities:

- depth and areal extent of cVOC impacts in the vadose zone;
- types and concentrations of cVOCs;
- nature and location of co-located contaminants that may affect SVE performance or selected treatment;
- depth to groundwater;
- soil moisture conditions;
- stratigraphy of the impacted zone (e.g., homogeneous sand, interbedded sands and silts);

- soil types and properties (e.g., structure, grain size distribution, air permeability, moisture content, organic carbon content); and
- survey map of site features (e.g., topography, existing structures, utilities, pavement), if applicable.

4.4 ADDITIONAL CHARACTERIZATION REFERENCES

The reader is referred to resources available on the DTSC, ITRC, USEPA, and ASTM websites, including the following references:

- *Preliminary Endangerment Assessment Guidance Manual* (DTSC, 1994);
- *Data Quality Objectives Decision Error Feasibility Trials Software (DEFT)-Users Guide, EPA QA/G-4D* (USEPA, 2001a);
- *Guidance on Choosing a Sampling Design for Environmental Data Collection, for Use in Developing a Quality Assurance Project Plan, EPA QA/G-5S* (USEPA, 2002a);
- *Guidance on Systematic Planning Using the Data Quality Objective Process, EPA QA/G-4* (USEPA, 2006a);
- *Data Quality Assessment: A Reviewer's Guide, EPA QA/G-9R* (USEPA, 2006b);
- *Systematic Planning: A Case Study for Hazardous Waste Site Investigations (QA/CS-1)* (USEPA, 2006c);
- *Data Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S* (USEPA, 2006d); and
- *Vapor Intrusion Pathway: A Practical Guideline* (ITRC, 2007).

5.0 RISK ASSESSMENT

Evaluation of potential risks to human health and the environment posed by contaminants at a site is part of the site characterization process and supports the risk management decision-making process to determine whether additional site investigation, further risk assessment, and/or remediation may be necessary. Depending on when a site begins using the PT&R approach, some risk assessment elements may have already been conducted and therefore do not need to be repeated.

Risk assessments range from simple screening assessments to site-specific, comprehensive risk assessments. A human health risk assessment should be conducted to characterize the potential cancer risks and noncancer health hazards posed by chemicals of concern (COCs) identified during site characterization (Section 5.2). A scoping-level ecological risk assessment should be conducted to determine whether further assessment of potential ecological impacts is necessary (Section 5.1). Cleanup goals and risk management considerations are addressed in Chapter 6.

5.1 ECOLOGICAL RISK ASSESSMENT

A scoping-level ecological investigation should be conducted to characterize the chemical, physical, and biological aspects of a site and to evaluate the potential for complete exposure pathways between ecological receptors and COCs (DTSC, 1996ab; USEPA 1997b). If the results of this qualitative assessment indicate further assessment is necessary (e.g., Phase I predictive assessment), then the PT&R process is not applicable to the site. Even if no currently-complete exposure pathways for ecological receptors are identified, the biological characterization of the site may become an important consideration for risk management decisions. For example, removal actions to protect human health may adversely impact ecological receptors or critical portions of their habitat.

5.2 HUMAN HEALTH RISK ASSESSMENT

For cVOCs in soil, vapor intrusion into indoor air is typically the most significant exposure pathway, and usually poses a greater risk from long-term (chronic) exposure than other exposure pathways. This section focuses on the soil vapor intrusion pathway, but also addresses evaluation of other exposure pathways for cVOCs in soil and groundwater.

Multiple lines of evidence should be used for evaluation of vapor intrusion into indoor air and associated health risks (ITRC, 2007). Typically, active soil gas samples are collected in the early stages of an exposure evaluation. Other lines of evidence include sampling data for passive soil gas samples, soil matrix, groundwater, sub-slab soil gas, and indoor air. Some or all of these lines of evidence are used in site characterization for defining the source location and nature and extent of cVOC contamination. Soil matrix data are also used for evaluating risks associated with direct contact exposure pathways for cVOCs in soil (Section 5.2.5). Measured and/or predicted groundwater COCs and concentrations are used to evaluate potential groundwater risks.

A screening level health risk assessment may be sufficient, depending on factors such as the complexity of the site, the degree of characterization of site contamination, and the anticipated remedy. Complex sites (such as those with multiple contaminants, impacts to multiple environmental media, and/or complex features) may require a site-specific comprehensive risk assessment subsequent to, or in lieu of, a screening risk assessment.

General guidance for conducting a site-specific comprehensive risk assessment is provided in *Risk Assessment Guidance for Superfund: Volume I--Human Health Evaluation Manual, Part A, Baseline Risk Assessment* (USEPA, 1989). Additional guidance for conducting risk assessments is available at the following agency websites:

- USEPA: http://www.epa.gov/oswer/riskassessment/risk_superfund.htm
- DTSC: http://www.dtsc.ca.gov/AssessingRisk/index.cfm.

The risk assessment process includes:

- identification of COCs and affected environmental media;
- identification of exposure pathways, land use, and potential human receptors;
- determination of exposure point concentrations;
- selection of toxicity criteria; and
- calculation and characterization of potential cancer risks and noncancer hazards.

5.2.1 Chemicals of Concern

All VOCs (both chlorinated and non-chlorinated) detected at the site should be included as COCs for risk assessment. In addition to detected VOCs, potential transformation products and other contaminants suspected to be present based on the CSM should be discussed and evaluated for potential inclusion in the quantitative risk assessment. Examples of transformation products include 1,2-dichloroethene and vinyl chloride from tetrachloroethene (PCE) and trichloroethene (TCE). High concentrations of primary contaminants in soil or soil gas might elevate analytical detection limits and preclude detection of other cVOCs. Further investigation and refined sampling and analytical methods may be needed to address these uncertainties.

5.2.2 Exposure Pathways and Land Use Scenarios

All potential exposure pathways and receptors identified in the CSM for current and potential future uses of the property should be described in the risk assessment. The land use and risk assessment exposure scenarios evaluated for this guidance are (1) residential and (2) industrial or commercial. Evaluation of off-site receptors or exposure scenarios other than default residential and industrial/commercial scenarios for the baseline risk assessment requires site-specific adjustment to the PT&R approach and additional consultation with the DTSC.

Exposure to VOCs in shallow soil can occur by several pathways, including inhalation of VOCs that have migrated from the subsurface into indoor air, inhalation of outdoor air, direct contact with soil (incidental ingestion and dermal contact), and ingestion of food products contaminated with cVOCs from soil or groundwater. Because vapor intrusion into indoor air of buildings is the most significant exposure pathway of concern for cVOCs at most sites, the vapor intrusion pathway is often the primary focus of risk assessments. However, other factors, such as the nature and extent of contamination or the current or potential land uses at a site, may warrant evaluation of risks associated with direct soil exposure pathways. DTSC should be consulted regarding evaluation of soil exposure pathways for sites with cVOC contamination.

Exposure to cVOCs that have migrated from vadose zone soil to groundwater, or are predicted by model simulations to reach groundwater (see Section 4.2), should be evaluated. Exposure pathways for cVOCs in groundwater include, but are not limited to, ingestion, dermal contact during showering/bathing, and inhalation of vapors released indoors from household use of groundwater. DTSC should be consulted regarding groundwater exposure pathways for sites with cVOC contamination.

5.2.3 Exposure Point Concentration

The approach used for estimating exposure point concentration at a given site depends on the matrix sampled, spatial and temporal scale of samples, spatial and temporal differences in COC concentrations, and land use.

Soil Gas. The maximum detected concentration of each COC in soil gas should be used as the exposure point concentration for the vapor intrusion risk assessment (DTSC, 2005a; Cal/EPA, 2005b). DTSC approval is required for use of any other metric for the exposure point concentration. Alternatively, point estimates of risk might be calculated using concentrations of COCs for each sampling location. Point estimates of risk are useful for spatial evaluation of contamination and risk at sites with multiple contaminants, and can be useful for evaluating remedial alternatives. For soil gas samples in which a site COC was not detected because of elevated detection limits (Section 5.2.1), the detection limit for the COC should be used as a proxy concentration (DTSC, 2005a). The distribution and extent of contamination at the site and the possible existence of localized areas of higher concentrations (i.e., hot spots) must be considered in both risk assessment and risk management.

Soil Matrix. For sites with high concentrations of cVOCs, soil matrix data can be used to identify locations with cVOC concentrations exceeding saturation limits for the soil and provide concentration data for soil exposure assessments. For sites at which the soil saturation limit for a cVOC is exceeded, the evaluation of vapor intrusion risk requires additional consultation with DTSC. Maximum detected concentrations of cVOCs in shallow soil matrix samples should be used for screening-level soil risk assessments (DTSC, 1994; and updates). In consultation with DTSC, the estimated average concentration (95 percent upper confidence limit of the arithmetic mean) may be used at sites with sufficient characterization of cVOCs in soil matrix.

Groundwater. Exposure point concentrations for cVOCs in groundwater should be based on concentration data collected from monitoring wells over a period of time that allows assessment of temporal trends. For sites at which cVOCs have not yet reached groundwater, concentrations predicted by modeling can be used to support risk estimates (see Section 4.2). A combination of monitoring data and modeling might be appropriate for estimating exposure point concentrations at some sites. The maximum measured or model-predicted concentration of cVOCs in groundwater should be used. DTSC approval is required for use of other metrics for the exposure point concentration.

The data quality objectives (DQOs) for data used to support the exposure point concentration for groundwater will depend on the exposure pathways being evaluated (e.g., vapor intrusion, drinking water). For example, evaluation of vapor intrusion focuses on concentrations at the water table (DTSC 2005a).

Both groundwater and soil gas data should be used to develop the exposure point concentration for the vapor intrusion pathway. Data from both media should be used to estimate the indoor air exposure concentration and the higher predicted exposure concentration should then be used for assessing vapor intrusion risks (DTSC, 2005a).

5.2.4 Health Risk Assessment for Vapor Intrusion into Indoor Air

The *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air* (Vapor Intrusion Guidance; DTSC 2005a, revision pending) should be followed for conducting preliminary and/or site-specific screening evaluation of risks associated with VOCs. The Vapor Intrusion Guidance provides default attenuation factors for estimating indoor air concentrations from soil vapor concentrations for use in preliminary screening risk assessments and also describes procedures for estimating site-specific soil vapor attenuation factors and predicting indoor air VOC concentrations and risks. Current USEPA vapor intrusion guidance is provided in *Evaluating the Vapor Intrusion to Indoor Air Pathway from Groundwater and Soils* (USEPA, 2002b). The most current toxicity criteria available from Cal/EPA and USEPA should be used. Cumulative cancer risks and noncancer hazards should be calculated for sites with multiple VOCs.

Although soil gas data are preferred for evaluation of vapor intrusion, preliminary risk screening with groundwater monitoring data might be conducted in limited cases. When groundwater data is used, the Vapor Intrusion Guidance should be followed and the vapor intrusion risk associated with both soil gas and groundwater should be evaluated. Soil sampling might be necessary at some sites, such as those with high concentrations of VOCs and/or where site conditions preclude soil gas sampling (see Section 4.1). In consultation with DTSC, an approach can be developed for evaluation of the soil vapor intrusion into indoor air pathway.

5.2.5 Health Risk Assessment for Exposures to cVOCs in Soil

In addition to soil vapor intrusion into indoor air, evaluation of risks associated with exposures to cVOCs in soil matrix may be warranted at sites with high concentrations of

cVOCs in shallow soil (0 to 15 feet below ground surface). Emissions of cVOCs into outdoor air may be significant. DTSC should be consulted regarding evaluation of exposures to cVOCs in soil and application of DTSC guidance. Generally, the DTSC *Preliminary Endangerment Assessment Guidance Manual* (PEA Manual; DTSC, 1994; and updates) and updated exposure factors provided in *DTSC Human Health Risk Assessment Note 1: Recommended DTSC Default Exposure Factors for Use in Risk Assessment at California Military Facilities* (HHRA Note 1; DTSC 2005b) should be followed.

5.2.6 Health Risk Assessment for Exposures to cVOCs in Groundwater

The PEA Manual (DTSC, 1994; and updates) and updated exposure factors provided in HHRA Note 1 (DTSC, 2005b) should be used for assessment of risks associated with exposure to cVOCs in groundwater.

5.2.7 Human Health Screening Levels

Human health screening levels are risk-based concentrations of chemicals in specific environmental media. Risk-based concentrations (also referred to as health-based concentrations) are developed using a target cancer risk or noncancer hazard quotient. The calculations rely on multiple assumptions and factors for estimating contaminant environmental fate and transport and receptor exposures for a hypothetical (or specific) site. Generally, conservative default exposure assumptions are used to derive these screening levels. For carcinogens, risk-based concentrations are developed for both cancer risk and noncancer hazard, and the lesser (more protective) concentration is selected as the screening level.

Screening levels based on default assumptions can be used for screening risk assessments. Site-specific risk-based concentrations may also be developed. Screening-level and/or site-specific risk-based concentrations are used in development of RAOs and cleanup goals (Chapter 6).

For screening risk assessments, cancer risk and hazard are estimated by dividing the maximum concentration of each COC by the corresponding medium-specific screening level (see Sections 5.2.7.1, 5.2.7.2, and 5.2.7.3). The ratio of the exposure point concentration to the risk-based concentration is multiplied by the target risk or hazard quotient from which the risk-based concentration was calculated (10^{-6} risk and hazard quotient of 1 for screening assessments). When using risk-based screening levels for assessing risks, both cancer risk and hazard must be evaluated for carcinogenic COCs, and cumulative risk and hazard for multiple COCs and exposure pathways must be presented. For the vapor intrusion into indoor air pathway, the maximum detected concentration of each COC in soil gas is compared with the corresponding screening level for soil gas.

Risk-based concentrations for the residential scenario should be used for screening risk assessments. In addition to the residential scenario, risk assessments for industrial, commercial, and other land use scenarios might be conducted for the evaluation of

remedies and the risk management decision process. Sites with individual chemical or cumulative cancer risks greater than 1 x 10^{-6} or noncancer hazards (hazard index) greater than 1 for the residential scenario should be considered for further risk management evaluation (see Chapter 6).

5.2.7.1 Screening Assessment for cVOCs in Soil Gas

The Vapor Intrusion Guidance (DTSC, 2005a, revision pending) should be used to develop risk-based screening levels for cVOCs in soil gas. Default soil gas attenuation factors provided in the Vapor Intrusion Guidance can be used to develop generic risk-based screening levels. Alternatively, the USEPA spreadsheet version of the Johnson and Ettinger model for vapor intrusion into indoor air and certain assumptions for building properties provided in the Vapor Intrusion Guidance can be used with data for site-specific soil properties to derive soil gas attenuation factors and screening levels. For sites or areas for which soil matrix samples are necessary in addition to soil gas data, Appendix E of the Vapor Intrusion Guidance provides procedures for using soil matrix data to estimate soil gas concentrations and discusses the limitations and uncertainties in using soil matrix data.

5.2.7.2 California Human Health Screening Levels

California Human Health Screening Levels (CHHSLs) are based on standard exposure assumptions and chemical toxicity values published by Cal/EPA and the USEPA, and can be used for evaluation of cVOCs in soil gas (Cal/EPA, 2005ab). The CHHSLs for cVOCs are risk-based concentrations for soil gas for the vapor intrusion/indoor air exposure pathway only. Soil gas CHHSLs were developed using the USEPA spreadsheet version of the Johnson and Ettinger model for soil vapor intrusion into indoor air.

The CHHSLs might not be adequately protective for estimating impacts to indoor air in structures with: basements; significant openings to the subsurface; preferential pathways for vapors (such as utility openings); or substandard ventilation systems. Sites with conditions significantly different from those assumed for the CHHSLs warrant a site-specific evaluation using the Vapor Intrusion Guidance (DTSC, 2005a; revision pending).

Toxicity criteria used for the CHHSLs should be reviewed prior to use and updated (i.e., adjust the screening level) as necessary. The current list of CHHSLs can be found at http://www.oehha.ca.gov/soil.html. The guidance document on use of CHHSLs for screening risk assessments (Cal/EPA, 2005b) should be consulted.

5.2.7.3 Soil Screening Levels for Soil Matrix

Risk-based screening levels for contact exposure pathways for COCs in soil can be developed using the PEA Manual (DTSC, 1994; and updates) and current exposure parameter values recommended in HHRA Note 1 (DTSC, 2005b). As applicable,

CHHSLs for non-VOCs present at the site may be used for soil exposure pathways in the screening risk assessment.

USEPA Regional Screening Levels (RSLs) for soil matrix may be used for screening evaluation of soil exposure pathway risks for COCs (ingestion, dermal contact, inhalation of outdoor air). DTSC guidance on use of RSLs (DTSC, 2009bc), including adjustments for Cal/EPA toxicity criteria, should be followed. As with other screening levels, both cancer risk and hazard must be evaluated for carcinogenic COCs, and cumulative risk and hazard for multiple COCs must be estimated. The RSLs do not include the vapor intrusion pathway, and therefore should be used in conjunction with one of the aforementioned vapor intrusion assessments.

5.2.7.4 Screening Levels for cVOCs in Groundwater

The Vapor Intrusion Guidance (DTSC, 2005a, revision pending) should be used to develop risk-based screening levels for cVOCs in groundwater for the vapor intrusion pathway (Sections 5.2.4 and 5.2.7.1). A partitioning model is used to estimate groundwater concentrations from the risk-based soil vapor concentrations.

For exposures to groundwater via pathways other than vapor intrusion (ingestion, dermal contact from bathing, inhalation of vapors emitted into indoor air from household use of groundwater), the PEA Manual (DTSC, 1994; and updates) and updated exposure factors provided in HHRA Note 1 (DTSC 2005b) should be used for development of risk-based concentrations of cVOCs in groundwater.

USEPA RSLs for tap water may be used for screening evaluation of groundwater exposure pathway risks for COCs (ingestion, inhalation of vapors emitted into indoor air from household use of groundwater). DTSC guidance on use of RSLs (DTSC, 2009bc), including adjustments for Cal/EPA toxicity criteria, should be followed. As with other screening levels, both cancer risk and hazard must be evaluated for carcinogenic COCs, and cumulative risk and hazard for multiple COCs must be estimated. The RSLs for tap water do not include dermal exposure or the groundwater vapor intrusion pathway, and therefore they should be used in conjunction with one of the aforementioned assessments.

6.0 CLEANUP GOALS

The findings of the risk assessment (Chapter 5) can be used, along with consideration of site-specific characteristics, to guide establishment of RAOs and associated cleanup goals. This chapter discusses cleanup goals for the protection of human health and groundwater (Sections 6.1 and 6.2, respectively), risk management considerations (Section 6.3), short-term risks during remediation (Section 6.4), and assessment of risk posed by residual cVOC concentrations (Section 6.5).

6.1 Cleanup Goals for Protection of Human Health

Factors that are considered in the development and selection of risk-based cleanup goals include the health impact endpoint (cancer risk and/or noncancer hazard), the intended use of the property (e.g., residential, industrial/commercial), exposure pathways, and the number of COCs. Remedy selection at some sites may have to address multiple exposure pathways. Methods and scenarios for evaluation of human health risks and development of risk-based concentrations are described in Section 5.2, and include exposures by vapor intrusion into indoor air and exposures to COCs in soil and groundwater.

As a starting point for development of risk-based cleanup goals, an initial cleanup goal of 1×10^{-6} should be calculated for each carcinogenic COC. For noncancer hazard, the risk-based cleanup goal for each COC should be less than or equal to a cumulative hazard index of 1. When a site has multiple COCs that contribute significantly to calculated excess total risk or hazard, the risk-based cleanup goal for each COC may need to be adjusted to a lower concentration to reduce the overall cumulative risk and/or hazard to an acceptable range. Another option is to use point estimates of cumulative risk for spatial evaluation of risk, as indicated in Section 5.2.3. Risk management decisions that would allow cleanup goals with greater risks or hazards may be made on a site-by-site basis (Section 6.3).

Residential and industrial/commercial land use scenarios are considered under the PT&R approach. Recommended exposure assumptions may be found in the Vapor Intrusion Guidance (DTSC, 2005a; revision pending), HHRA Note 1 (DTSC, 2005b), or the documentation for CHHSLs (Cal/EPA, 2005ab). HHRA Note 1 includes default exposure assumptions for a construction scenario. Other land use and exposure scenarios (such as maintenance worker or park visitor scenarios) require use of site-specific exposure factors.

Human health screening levels such as CHHSLs (Section 5.2.7.2) may be considered as risk-based cleanup goals to streamline the remedy selection process. Soil gas screening levels for cVOCs are based on a single pathway of exposure—inhalation of soil vapors migrating from the subsurface into indoor air. For most sites, soil gas screening levels are adequately protective for soil exposure pathways. For sites at which soil gas samples are not feasible, DTSC should be consulted for development of indoor air risk-based concentrations for soil matrix and/or groundwater, or for an alternate approach.

6.2 Soil Cleanup Goals for Protection of Groundwater

If the PT&R approach is being implemented to decrease or eliminate an on-going threat to groundwater posed by cVOCs in vadose zone soil, the process of establishing cleanup goals should also consider soil and soil gas concentrations necessary to protect water resources. Cleanup goals protective of groundwater are established based on site-specific considerations and applicable policies, statutes, and regulations. Potentially applicable policies, statutes, and regulations include:

- State and federal statues and regulations;
- California State Water Resources Control Board (SWRCB) and California Regional Water Quality Control Board (RWQCB) policies;
- water quality control plans adopted by the SWRCB and RWQCB; and
- relevant standards, criteria, and advisories adopted by State and federal agencies.

DTSC has not identified a single methodology that can be used to establish soil cleanup goals for protection of groundwater. Examples of methods that could be used to establish cleanup goals include use of unsaturated zone fate and transport modeling (Section 4.2) and "lookup" tables of screening levels (e.g., USEPA RSLs for Soil for Protection of Groundwater). The method used for a given site should be selected in consultation with, and with the approval of, the regulatory agencies overseeing the site cleanup.

6.3 RISK MANAGEMENT

The final cleanup goal and remediation strategy is a risk management decision based on numerous factors. The risk-based point of departure for risk management decisions is 1×10^{-6} for cancer risk and a hazard index of 1 for noncancer risk. Sites with individual chemical risk or cumulative risk from multiple COCs in excess of these points of departure may require remediation. In general, risks that are less than 1×10^{-6} are called *de minimus* and are not considered to require regulatory intervention. The range of risk (excess cancer risk posed by a site) that is considered as potentially acceptable for risk management decisions starts at 1×10^{-6} (one in a million) and goes up to 1×10^{-4} (one in ten thousand).

Development of RAOs and final cleanup goals at a site involves consideration of the:

- nature and magnitude of human health risks and uncertainties,
- current and future land use,
- risk-based cleanup goals and other criteria or requirements (including the RAOs),
- potential impact to ecological receptors and/or their habitat,
- technical and economic feasibility,
- regulatory criteria, and
- community concerns.

Many factors are considered in the final risk management decisions and the acceptable risk for a project may be greater than the point of departure. Evaluation of each remedial alternative for the site should include an estimate of the reduction in risk and a determination of risk management measures needed for contamination remaining in excess of risk-based concentrations (see Sections 6.5, 8.5.1, and 9.3.8). Risk management decisions (including mitigation and control of potential exposure) and technical supporting information are presented in remedy selection documents (see Section 7.2).

6.4 SHORT-TERM RISKS DURING REMEDIATION

Short-term risks associated with implementation of a remedy should be considered during evaluation of remedial alternatives. For many sites, a qualitative evaluation of risks associated with implementation of remedial alternatives is sufficient, but other sites will require a more quantitative evaluation (USEPA, 1991ab). Releases of cVOCs from soil during cleanup activities might pose significant risks to people who live or work in the vicinity of the site and to workers who are involved in the site cleanup. Evaluation and selection of remedial alternatives should identify and consider measures to monitor and control short-term exposure and risks. This evaluation should include consultation with local agencies (e.g., air quality management district). Site safety plans should be developed. Implementation of certain remedies might require perimeter monitoring of vapors (see Sections 8.2.2 and 9.3.3). Community concerns associated with short-term risks are addressed through the public participation process (see Section 3.1.3).

6.5 POST-CLEANUP EVALUATION

Following the completion of the remedial action, a post-cleanup risk evaluation may be required when residual cVOC concentrations remain, as indicated by confirmation sampling results. Risks can be estimated using the same procedures as those used for the pre-remediation baseline risk assessment or another approach (such as site-specific risk assessment or screening risk assessment as summarized in Section 5.2).

Confirmation sampling approaches for soil excavations and SVE systems are discussed in Sections 8.5.1 and 9.3.8, respectively. Additional information for confirmation sampling associated with the PT&R alternatives is provided in Appendices C and E.

7.0 EVALUATION OF CLEANUP TECHNOLOGIES FOR CHLORINATED VOCs IN VADOSE ZONE SOIL

In a conventional cleanup process, if the results of the risk screening process indicate that a cleanup action is warranted, the next step is an evaluation of the technologies appropriate for remediation of cVOCs in soil. This chapter provides the administrative record, technical basis, and evaluation necessary for streamlining the cleanup alternative evaluation. This chapter also addresses the site-specific evaluation and remedy selection process for cleanup of cVOC contaminated soils. Much of the streamlining is achieved by the DTSC study summarized in Section 7.1. The streamlined approach for evaluating remedial alternatives can be documented by:

- including pertinent sections of this PT&R guidance in the administrative record[1] and
- including a discussion regarding the use of the PT&R approach for the cleanup alternative selection in the decision document.

7.1 TECHNICAL BASIS FOR PT&R GUIDANCE FOR SITES WITH CHLORINATED VOC CONTAMINATION IN VADOSE ZONE SOIL

DTSC conducted a study of sites where the primary COCs included cVOCs in vadose zone soil and for which DTSC provided oversight of the cleanup process. The objective was to identify the technologies that were consistently evaluated as potential remedies and to identify the remedies that were subsequently selected at a site. The study, equivalent to the screening and evaluations conducted under a FS or CMS, included the following activities:

- review of literature relevant to sites with cVOC contamination (see Appendix B for a summary of the technologies reviewed and applicable at sites with cVOCs in unsaturated soil);
- identification of a representative number of DTSC sites with cVOC contaminated soils;
- review of the decision documents to determine which cleanup alternatives were routinely either screened out or selected for the remedy; and
- identification of the rationale for selection of the remedy.

DTSC reviewed its EnviroStor database to identify sites with vadose zone soils impacted with cVOCs. The database evaluation identified 90 sites for which remedy selection or implementation had occurred as of June 2009. These cleanup decisions occurred as either an interim removal action or as a final remedy. Table 3 summarizes the types of sites included in the DTSC study.

[1] Alternatively, include the PT&R guidance as an electronic appendix to cleanup alternative evaluation document.

Table 3. Cleanup Options Selected to Address Chlorinated VOCs in Vadose Zone Soil for the Sites Evaluated by DTSC Study

DTSC Site Type (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Corrective Action (16[2])	1	14	0	6	0	0
Military Facilities (19[2])	3	12	0	6	2	0
Schools (3)	0	1	0	2	0	0
State Response/ NPL[3] (33[2])	7	19	0	17	4	1
Voluntary Cleanup (19[2])	4	11	2	13	0	0

Notes:
[1] IC is institutional control. Usually used in conjunction with another cleanup option.
[2] Some sites in this category selected multiple cleanup options (i.e., this number is not simply the sum of values listed in this row).
[3] National Priorities List

The DTSC study compiled data about the site characteristics, including site activities, types of contaminants present, other affected media, and depth to groundwater. Notably, most of the sites reviewed had cVOC impacts to both vadose zone soil and groundwater and therefore had separate remedial alternatives for groundwater. The most frequently encountered contaminants included TCE, PCE, metals, and fuel-related compounds. Appendix B provides additional details regarding the characteristics of sites included in the DTSC study.

DTSC reviewed the cleanup alternative decision documents for the sites identified in the database review. The review focused on the cleanup alternatives that were considered and the factors that led to the selected cleanup alternative. DTSC evaluated three variables in detail:

- frequency of selection of the cleanup alternatives (Table 3);
- rationale for selection of the cleanup alternatives (described below); and
- rationale for rejection of the cleanup alternatives considered by the selection process (Table 4, Appendix B).

Based on this review, SVE and excavation/disposal were identified as the proven technologies for sites with cVOCs in vadose zone soil.

Table 4. Cleanup Options Considered for Chlorinated VOCs in Vadose Zone Soil for the Sites Evaluated by DTSC Study

Technology	No. of Site Alternatives Analyses Considering Technology	No. of Site Alternatives Analyses Rejecting Technology	Primary Reasons for Rejection During Cleanup Alternative Analysis[1]						
			Overall Protection	Compliance with ARARs[3]	Reduction of Toxicity, Mobility, Volume	Long-term Effectiveness	Short-term Effectiveness	Cost	Implementability
No Action	90	90	88	3	0	2	0	0	0
ICs[2] Only	34	32	29	2	1	2	0	0	0
Excavation/ Disposal	59	15	0	0	0	1	3	12	10
Soil Vapor Extraction	66	11	0	1	2	6	0	4	4
In Situ Treatment	17	15	1	0	1	10	0	6	10
Containment	20	13	6	2	4	3	0	1	1
Ex Situ Treatment	14	13	1	0	0	5	2	8	9

Notes:
1 National Contingency Plan (NCP) criteria
2 Institutional controls
3 Applicable or relevant and appropriate requirements

Review of the cleanup alternative decision documents indicates that SVE was the most frequently selected cleanup alternative for cVOCs in vadose zone soil. For many sites, the rationale for use of SVE as an interim removal action, or as a final cleanup alternative, was based on USEPA's designation of SVE as the primary presumptive remedy in *Presumptive Remedies: Site Characterization and Technology Selection for CERCLA Sites with VOCs in Soils* (USEPA, 1993b). Additional rationale for selecting SVE included the ability to remove cVOC mass at depths greater than could be achieved by excavation/disposal, particularly where cVOCs in the vadose zone posed an on-going threat to groundwater. SVE was less likely to be chosen for sites with shallow groundwater, shallow VOC impacts, or where multiple contaminant groups were present.

Excavation/disposal was the next most frequently selected cleanup alternative for cVOCs in soil. This technology was often selected based on its demonstrated effectiveness in addressing shallow soil impacts or source areas and its ability to provide timely remediation of the site. Based on the sites reviewed, the alternative was selected for impacted soil volumes ranging from about 20 to 30,000 cubic yards and for sites with first groundwater encountered at depths less than about 20 feet bgs. When not selected, excavation/disposal was typically rejected based on cost or ability to implement at a given site.

Seventeen sites included in the DTSC study evaluated one or more *in situ* treatment technologies to address cVOCs in vadose zone soil. Of these sites, only two sites selected an *in situ* treatment technology. One site selected reductive dechlorination to remediate a cVOC source near the capillary fringe; SVE was selected as a contingent remedy. The other site selected a combination of SVE and *in situ* chemical reduction to address both cVOCs and hexavalent chromium. *In situ* treatment approaches were most often rejected based on concerns regarding the ability to effectively treat the cVOCs, unproven effectiveness of some treatment techniques, ability to control resulting impacts to groundwater, and implementability.

Twenty sites included in the DTSC study evaluated containment by capping as a remedial technology for soil impacts. The rationale for selecting containment as part of the cleanup approach was based on the ability to provide sufficient protection and the ability to implement with the current or planned land use. This technology was most frequently rejected based on the inability to reduce or sufficiently control the cVOC contamination, an incompatibility with the current or planned land use, and the requirement for long-term stewardship.

Fourteen sites included in the DTSC study evaluated *ex situ* treatment. All but one site rejected *ex situ* treatment primarily based on cost and implementability considerations. *Ex situ* treatment was selected at one site because the approach was determined to be feasible based on the volume of impacted soil (greater than 200,000 cubic yards) and the ability to reuse the treated soil on-site.

7.2 FOCUSED EVALUATION AND SELECTION OF CLEANUP ALTERNATIVE

Under State and federal law, an analysis of alternatives is required for sites undergoing remediation. Following an initial evaluation, a more detailed and focused evaluation that considers the site characteristics must be conducted on the PT&R alternatives. Because the cleanup alternative screening evaluation presented in Section 6.1 and Appendix B was conducted in accordance with the initial screening requirements of a FS and CMS, it may be used in lieu of a site-specific initial screening evaluation for sites undergoing the streamlined PT&R approach, provided that the use of the PT&R screening evaluation is cited in the administrative record.

The next step in the PT&R approach is to determine whether excavation/disposal or SVE is the most appropriate cleanup alternative. The alternatives evaluation may consist of a site-specific evaluation of the no action, excavation/disposal, and/or SVE alternatives. Focusing on these PT&R alternatives is consistent with the National Contingency Plan (NCP) when:

- the number of alternatives evaluated for a site are reasonable;
- the number of alternatives evaluated are based on the scope, characteristics, and complexity of the site; and
- detailed analyses need only be conducted on a limited number of alternatives that represent viable approaches to the cleanup.

Application of the PT&R approach in this guidance does not preclude consideration of additional cleanup alternatives if determined to be appropriate for a site. However, use of the PT&R approach would still reduce the burden associated with screening and evaluating those additional cleanup technologies being considered.

As illustrated in Figure 3, both alternatives have the potential to allow unrestricted use of the site. However, operation of a SVE system has a longer duration and typically necessitates a regulatory oversight agreement. The focused alternatives evaluation may be prepared under State or federal guidelines, as summarized in Table 5.

In addition to using the DTSC initial alternatives evaluation (Section 7.1), the following site-specific elements of the remedial alternative evaluation process should be addressed in the appropriate remedy selection document:

- identification of applicable federal/State/local requirements (known as applicable or relevant and appropriate requirements (ARARs) under some cleanup processes);
- establishment of site-specific RAOs; and
- evaluation of the PT&R alternatives and the no action alternative against the applicable NCP criteria[2]:

[2] Only the effectiveness, implementability, and cost criteria apply to the DTSC RAW process. For hazardous waste sites, the RCRA-balancing criteria can be used instead of the NCP criteria.

Threshold Criteria
1) overall protection of human health and the environment,
2) compliance with federal/State/local requirements,

Balancing Criteria
3) long-term effectiveness and permanence,
4) reduction of toxicity, mobility or volume through treatment,
5) short-term effectiveness,
6) implementability based on technical and administrative feasibility,
7) cost,

Modifying Criteria
8) State and local agency acceptance,
9) community acceptance.

Additional criteria may also be considered in the remedial alternative evaluation process for a given site. For example, an evaluation of the sustainability of each remedial alternative could be used to identify potential environmental stressors (e.g., resource depletion, physical disturbances) and their associated impacts. The *Interim Advisory for Green Remediation* (DTSC, 2009d) provides additional discussion regarding sustainability as a criterion in the remedy selection process.

Figure 3. Summary of PT&R Cleanup Alternatives

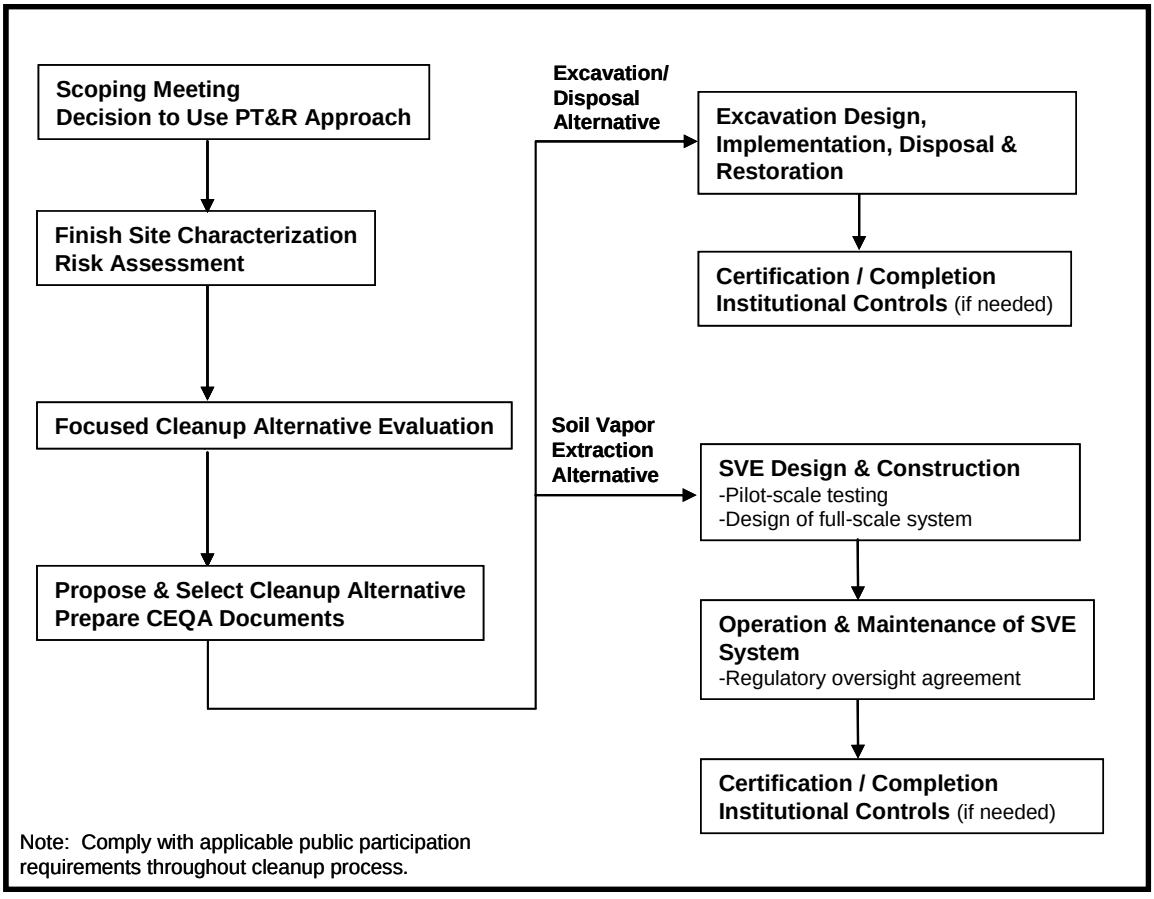


Table 5. State and Federal Guidelines for Focused Alternatives Evaluation

Law	Process	Description	Reference(s)
HSAA	Remedial Action Plan (RAP)[1]	Process for developing, screening, and detailed evaluation of alternative remedial actions for sites. Response action selection document under HSC §25356.1.	DTSC, 1995
	Removal Action Workplan (RAW) [1, 2]	Prepared when a proposed, non-emergency removal action or a remedial action is projected to cost less than $2,000,000. Response action selection document under HSC §25356.1.	DTSC, 1993, 1998
CERCLA	Feasibility Study (FS)	Process for the development, screening, and detailed evaluation of alternative remedial actions for sites.	USEPA, 1988, 1999
	Engineering Evaluation/ Cost Analysis (EE/CA)	Analogous to, but more streamlined than, the FS. Identifies the objectives of the removal action and analyzes the effectiveness, implementability, and cost of various alternatives that may satisfy these objectives.	USEPA, 1993a
RCRA or HWCL	Corrective Measures Study (CMS)[1]	Mechanism used by the corrective action process to identify, develop, and evaluate potential remedial alternatives.	USEPA, 1991c, 1994, 1997c
HSAA, HWCL, RCRA, CERCLA	Interim Measures[1] or Interim Actions	Actions to control and/or eliminate releases of hazardous waste and/or hazardous constituents from a facility prior to the implementation of a final corrective measure or remedy.	

Notes:
1 See Appendix D for link to example or sample documents.
2 A feasibility study is not required for RAW process. However, the RAW should evaluate effectiveness, implementability, and cost of various removal alternatives.
CERCLA – Comprehensive Environmental Response, Compensation, and Liability Act
HSAA – Hazardous Substance Account Act
HWCL – Hazardous Waste Control Law
RCRA – Resource Conservation and Recovery Act

Regardless of the process used to evaluate and select the cleanup alternative for a site, the alternatives evaluation report generally should:

- discuss and present documentation showing that the PT&R approach is appropriate;
- identify and provide the rationale for the preferred alternative for the site;

- document the site-specific RAOs, regulatory requirements, and the detailed alternatives analysis;
- include preliminary design information for final remedy implementation; and
- discuss how the PT&R approach will be integrated with any groundwater remedial measures or vapor intrusion mitigation measures.

Necessary CEQA documents are usually prepared concurrently with remedy selection documents, if not sooner (see Section 7.4 for further discussion of CEQA requirements). Once approved by DTSC, the draft remedy selection and CEQA documents are circulated for public comment (DTSC, 2003).

The administrative record for the site should, among other things, include the following elements:

- copy of pertinent sections of this PT&R guidance (alternatively, include the PT&R guidance as an electronic appendix to cleanup alternative evaluation document); and
- responses to any comments pertaining to the decision to use the PT&R approach.

7.3 DESIGN AND IMPLEMENTATION OF SELECTED CLEANUP ALTERNATIVE

The operational and technical plans for implementing the selected cleanup alternative should be prepared and submitted to DTSC, either in the remedy selection document (if appropriate) or as separate submittals. Examples of operational plans include the health and safety plan, transportation plans, and confirmation sampling plan. The technical plans contain the specific engineering design details of the proposed cleanup approach, including designs for any long-term structures (e.g., SVE system). As applicable, the design plans should include the design criteria, process diagrams, and final plans and specifications for the structures as well as a description of any equipment to be used to excavate, handle, and transport contaminated soil. Field sampling and analysis plans that address sampling during implementation and confirmation sampling to assess achievement of the RAOs should also be prepared.

Chapters 8 and 9 provide further discussion of the design and implementation for the PT&R alternatives.

7.4 CALIFORNIA ENVIRONMENTAL QUALITY ACT

Remediation of cVOC contamination must meet all applicable local, State and federal requirements, including CEQA. CEQA (Pub. Resources Code, sec. 21000 et seq.) requires public agencies carrying out or approving a project to conduct an environmental analysis to determine if project impacts could have a significant effect on the environment. Public agencies must eliminate or reduce the significant environmental impacts of their decisions whenever it is feasible to do so.

All proposed projects for which the DTSC has discretionary decision-making authority are subject to CEQA if they potentially impact the environment. Examples of approval actions which require CEQA review and documentation include: RAPs, interim measures, RAWs, and corrective actions. For further information, DTSC's CEQA-related polices and procedures are available at www.dtsc.ca.gov.

8.0 DESIGN AND IMPLEMENTATION OF EXCAVATION / DISPOSAL ALTERNATIVE

This chapter describes the approach to be used to remove contaminated soil exceeding site cleanup goals for cVOCs (and other co-located contaminants, if identified). Please recognize that this chapter is intended as guidance. All elements discussed may not be applicable to a given site.

8.1 EXCAVATION, DISPOSAL, AND RESTORATION PLAN

A workplan should be prepared which identifies the logistical procedures and site activities associated with excavation, disposal and site restoration. The actual title of this plan will depend on the cleanup process applied to the site. For example, DTSC's Removal Action Workplan (RAW) process incorporates the required plan elements. DTSC's Remedial Action Plan (RAP) and corrective action processes often require preparation of a separate plan. However, additional streamlining under the PT&R approach could be achieved if the plan is included with another document (e.g., as an appendix to the RAP). For the purposes of this chapter, the workplan is referred to as the "excavation, disposal, and restoration plan" (EDRP). Appendix D provides a link to an EDRP sample and annotated outlines for supporting documents.

Major topics and elements of the EDRP include the following:

- site background
- nature and extent of contamination
- clean-up goals
- objectives and scope of plan
- project organization and schedule
- description of the technical basis for the approach (e.g., why excavation/disposal was selected as the cleanup alternative; estimated extent of excavation, estimated volume of soil to be excavated)
- pre-excavation activities;
- excavation activities
- dust control and air monitoring
- waste management
- backfill and site restoration activities
- quality assurance and quality control (QA/QC)
- health and safety monitoring
- reporting

The EDRP should be supported by the following documents, as applicable, which can be submitted separately or as appendices to the plan:

- site-specific health and safety plan (HASP)
- storm water pollution prevention plan (SWPPP)
- community air monitoring plan
- confirmation sampling plan (see Section 8.5.1, Appendix E)
- public participation plan (see Appendix D)
- stockpile sampling plan
- transportation plan (see Appendix D)

8.2 PRE- EXCAVATION ACTIVITIES

Prior to conducting fieldwork, a series of project management and regulatory tasks should be completed. The general areas that require preparatory activities include:

- site access
- permits
- location of underground utilities
- health and safety
- waste management
- scheduling of staff and equipment resources
- coordination with laboratory for analysis and assessment
- arrangements for sample management
- coordination with off-site disposal facility
- notifications (e.g., agencies, public)

Local jurisdictions, such as municipal public works departments and air districts, often require excavation or grading permits. Depending on the volume of soil to be excavated or disturbed, the RWQCB may specify waste discharge requirements, preparation of a SWPPP, and/or a National Pollution Discharge Elimination System (NPDES) permit. The key elements of the permit application specific to the location of the excavation should be identified. Some municipalities have restrictions on the type of equipment that can be used within a specified distance from water mains, sewer lines, and utility lines. In addition, air districts may require a similar application that identifies the mitigation measures to reduce or eliminate air dispersal of contaminants.

8.2.1 Dust Control and Air Monitoring

The EDRP should discuss the actions (specified in the remedy selection document) that will be implemented to control fugitive dust and cVOC emissions during implementation of the remedy. Dust control is required during construction, demolition, excavation, temporary containment, soil loading for transportation, and other earthmoving activities, including, but not limited to, land clearing, grubbing, scraping, travel on site, and travel on access roads to and from the site.

Most air districts and/or County environmental health departments have recommended or required dust mitigation measures and/or engineering controls. Applicable air pollution regulations, monitoring requirements, performance criteria, and acceptable

control strategies should be cited and described. The following items are generally considered:

- wind breaks and barriers, or ceasing work when wind speeds are above a certain level;
- frequent water applications;
- application of soil additives;
- control of vehicle access;
- vehicle speed restrictions;
- covering of piles;
- use of gravel and rumble strips at site exit points to remove caked-on dirt from tires and tracks;
- decontamination and tracking pad to thoroughly wash and decontaminate vehicles before leaving the site;
- wet sweeping of public thoroughfares; and
- cause for work stoppage.

8.2.2 Work Zone and Community Air Monitoring

Dust mitigation measures and/or engineering controls, implemented in conjunction with real-time and time-weighted average dust monitoring, are intended to ensure that dust generated during project activities will not have an adverse impact on site workers, the environment, or the community.

In addition to dust mitigation measures, most air districts and/or County environmental health departments set action levels to control the emission of cVOCs from excavating, grading, and handling (storage and loading) activities. These activities can produce significant volatilization of cVOCs from contaminated soil into the local atmosphere. Air monitoring for cVOC concentrations should be conducted within the exclusion/ decontamination zone for site worker safety, and outside of the soil removal and decontamination/exclusions zones (fence-line monitoring) to ensure that potential exposure of sensitive off-site receptors to site contaminants will not have any adverse effects. Exclusion-zone monitoring of cVOCs for site worker safety is further discussed in Section 8.7, Health and Safety Monitoring.

Community air monitoring (outside of the site fence-line) should be considered for activities occurring near residential communities, schools, and other sensitive receptors (e.g., elderly or high use community areas) to ensure that the implementation of the remedy does not pose a potential threat to off-site receptors. Site-specific risk-based action levels should be calculated, in consultation with DTSC, and included in the design.

8.3 EXCAVATION ACTIVITIES

8.3.1 Cal-OSHA Standards for Trenching and Excavations

The EDRP should address the applicable California Division of Occupational Safety and Health (Cal-OSHA) safety requirements for excavations (Cal. Code Regs., tit. 8, §1540, §1541, §1541.1). These requirements state that workers exposed to potential cave-ins must be protected by shoring, sloping, or benching the sides of the excavation, or placing a shield between the side of the excavation and the work area. These safety standards also provide for protection of the stability of adjacent structures. Any excavation four feet or deeper must have adequate means of access/egress every 25 feet of lateral travel from workers. Excavations greater than four feet deep require testing for hazardous atmospheres and protection from hazards associated with water accumulation. Entry into some excavations/ trenches may require a Cal-OSHA permit and compliance with Cal-OSHA regulations for trenching and excavation.

8.3.2 Surface Water Control Measures

If there is the potential for rainfall during the excavation activities, the EDRP should address surface water runoff, erosion control, and sediment control measures. These measures should conform to State and local requirements and should provide for segregation of surface water runoff from impacted and non-impacted areas.

8.4 WASTE MANAGEMENT

8.4.1 Management and Profiling of Excavated Soil

Excavated soil should be managed in accordance with applicable State and federal requirements, and as recommended in *Management of Remediation Wastes Under RCRA* (USEPA, 1998). Excavated soil may be hauled directly off site for disposal (provided arrangements have been made with a disposal facility) or may be stockpiled on site for further profiling. The EDRP should describe the measures that will be used to control emissions during soil handling and the measures that will be used to minimize mixing of soil containing higher COC concentrations with less impacted soils. A schematic or scaled map of the areas to be excavated and the locations where soil will be stockpiled should be included. Excavated soil should be segregated and stockpiled based on the existing site data. Stockpiles are typically segregated according to the disposal options (see Table 6).

Table 6. Disposal Alternatives for Excavated Soil Under the PT&R Approach

LEVEL OF CONTAMINATION	DISPOSAL ALTERNATIVES
Concentrations below acceptable risk levels	Can be used to backfill the original excavation
Impacted at levels above acceptable risk levels but below hazardous levels (nonhazardous solid waste)	Off-site disposal at Class I, Class II, or Class III landfill (depending on their waste acceptance criteria)
RCRA hazardous waste or California-only hazardous waste	Treatment to meet land disposal restrictions may be required before off-site disposal at Class I landfill. See text for further discussion.

Temporary stockpiles should be managed as identified in the EDRP. The plan should comply with the applicable requirements of the California Code of Regulations, title 22, division 4.5 and stockpiling requirements for remediation waste staging found in Health and Safety Code Section 25123.3(b)(4)(B). The EDRP should designate the locations for placement of stockpiles, address measures to prevent migration and/or dispersal of the soil (e.g., liners, covers), describe the measures that will be used to control emissions, and identify the appropriate distance from the upper edge of any excavation. Representative samples should be collected and analyzed from the stockpiles to verify that the soil has been appropriately segregated and categorized.

If identified as a RCRA listed or characteristic waste or a California-only hazardous waste, contaminated soil that is excavated must be managed and disposed as such. Off-site management for RCRA hazardous wastes must be disposed in a landfill authorized to accept RCRA hazardous waste and must meet any applicable land disposal restrictions (LDRs). If the excavated soil exceeds specified LDR concentrations, the hazardous wastes must be treated to meet specific LDRs limits prior to land disposal. In addition, if the soil is a RCRA characteristic waste, all other underlying hazardous constituents found in the soil must meet their associated LDRs prior to disposal. Refer to *Management of Remediation Wastes Under RCRA* (USEPA, 1998) for optional LDR treatment standards for contaminated soils (typically ten times the concentration levels for a generated waste). If the excavated soil is below specified LDR concentrations, the soils do not need to be treated prior to land disposal and can be disposed of appropriately at a Class I landfill. Soil identified as California only hazardous waste is disposed of in a Class I landfill.

The sampling results from the soil stockpiles must be included in the waste profile form for the landfill operators to review and determine if the profile meets its acceptance criteria. Upon acceptance by a landfill, the stockpiled soil is loaded into the transport container (e.g., truck, rail car, bin) and transported to the landfill with appropriate documentation (e.g., under a hazardous waste manifest and LDR notification/ certifications for a Class I landfill, under a bill of lading for a Class II landfill).

8.4.2 Loading and Transportation

Soil transported for offsite management or disposal must be transported in accordance with applicable State and federal laws. Loading of transport containers should be adjacent to stockpiles or excavations, just outside designated exclusion zones. Any soil falling to the ground surface during loading should be placed back into the container. Loaded containers should be inspected to ensure that they are within acceptable weight limits and should be covered and inspected prior to departure to minimize the loss of materials in transit. The waste profile analyses should accompany the shipping document (i.e., bill of lading or hazardous waste manifest) to the offsite facility. Appendix D provides a link to an annotated outline for a transportation plan.

8.5 BACKFILL AND RESTORATION

Backfill operations can begin once the RAOs have been achieved, as demonstrated through confirmation sampling. Excavated areas should be restored to be consistent with future use and graded to ensure proper runoff.

8.5.1 Confirmation Sampling

Confirmation samples are collected to determine if the RAOs have been achieved and thus whether the removal action is completed. The scope of confirmation sampling activities is a function of the site-specific RAOs, the media to be sampled, and potential land re-use scenarios (e.g., residential, industrial). Appendix E provides further discussion of confirmation sampling for soil excavations.

Confirmation sampling activities should be conducted in accordance with an approved confirmation sampling plan (see Appendix E for annotated outline). Depending on site-specific circumstances and/or the site cleanup process, the confirmation sampling plan can be included as an appendix to a document (e.g., EDRP), incorporated into a document (e.g., RAW), or prepared as a standalone document. The plan and sampling activities should be prepared and implemented in accordance with standard geologic and engineering principles and practices using appropriately licensed and experienced professionals.

8.5.2 Borrow Source Evaluation

Borrow source evaluation should address the physical and chemical characteristics of the soil. Backfill soils should have physical properties consistent with engineering requirements for the planned site use. For example, the International Building Code typically requires a compaction between 90 and 95 percent. When selecting material for backfilling excavated areas, steps should be taken to minimize the chance of introducing soil to the site that may pose a risk to human health and the environment. As a general rule, fill should not be obtained from industrial areas, from sites undergoing environmental cleanups, or from commercial sites with potential impacts (e.g., former service stations, dry cleaners).

The *DTSC Information Advisory, Clean Imported Fill* (DTSC, 2001) suggests that two approaches can be used to demonstrate acceptable backfill materials: (1) providing appropriate documentation and conducting analyses as needed; or (2) collecting samples from the borrow area or borrow area stockpile and analyzing the samples for an appropriate list of parameters.

The selected analytes should be based on the source of the fill and knowledge of the prior land use. Table 7 summarizes potential contaminants based on the fill source area.

Table 7. Potential Contaminants Based on Land Use in Fill Source Area

FILL SOURCE AREA	POTENTIAL TARGET COMPOUNDS
Land near an existing freeway	metals, PAHs
Land near a mining area or rock quarry	metals, asbestos, pH
Agricultural land	pesticides, herbicides, metals
Residential or commercial land	VOCs, SVOCs, TPH, PCBs, metals, asbestos

From *DTSC Information Advisory, Clean Imported Fill* (DTSC, 2001)

A standard laboratory data package, including the QA/QC sample results, should accompany all analytical reports. Contaminants detected in the fill material should be evaluated for risk in accordance with the *Preliminary Endangerment Assessment Guidance Manual* (DTSC, 1994) or the methods described in Chapter 5. If contaminant concentrations exceeding acceptance criteria are identified in the soil, the fill should be deemed unacceptable and new fill material should be obtained, sampled, and analyzed.

Fill documentation should include detailed information on the previous land use(s) in the area from which the fill is taken, the findings of any environmental site assessments, and the results of any testing. If the documentation is inadequate, samples of the fill material should be collected and analyzed for an appropriate list of parameters. This may be the best alternative when large volumes of fill material are anticipated or when larger areas are considered as borrow areas.

If limited fill documentation is available, samples should be collected from the potential borrow area and analyzed for an appropriate list of parameters. If fill material is not characterized at the borrow area, it will need to be stockpiled until analyses have been completed. Table 8 provides recommended sampling frequencies for the fill soil. In general, approximately one sample should be collected and analyzed per truckload. This sampling frequency may be modified upon consultation with appropriate regulatory agencies if all fill material is derived from a common borrow area.

Composite or incremental sampling for fill characterization may or may not be appropriate, depending on the quality and homogeneity of the source/borrow area and

the potential contaminants. The *DTSC Information Advisory, Clean Imported Fill* (DTSC, 2001) provides further discussion on the use of composite samples for certain contaminant groups.

Table 8. Recommended Fill Material Sampling

EXTENT OF INDIVIDUAL BORROW AREA	NUMBER OF SAMPLES[1]
2 acres or less	Minimum of 4 samples
2 to 4 acres	Minimum of 1 sample for every 0.5 acres
4 to 10 acres	Minimum of 8 samples
Greater than 10 acres	Minimum of 8 locations with 4 subsamples per location
VOLUME OF BORROW AREA STOCKPILE	**NO. OF SAMPLES**
Up to 1,000 cubic yards	1 sample per 250 cubic yards
1,000 to 5,000 cubic yards	4 samples for first 1,000 cubic yards; 1 sample per each additional 500 cubic yards
Greater than 5,000 cubic yards	12 samples for first 5,000 cubic yards; 1 sample per each additional 1,000 cubic yards.

Notes:

1 The number of samples needed to characterize fill material is a site-specific decision.
From *DTSC Information Advisory, Clean Imported Fill* (DTSC, 2001)

8.6 QUALITY CONTROL / QUALITY ASSURANCE

The EDRP should address QA/QC procedures that will be followed during the excavation activities. For example, the EDRP should address field oversight and reporting, field documentation, and confirmation sampling. If a QAPP was prepared during the characterization phase, the plan may be amended to address the pertinent changes for the EDRP.

8.7 HEALTH AND SAFETY MONITORING

The HASP addressing site-specific excavation, restoration, and the health and safety issues should be included or referenced in the EDRP. The health and safety requirements should apply to all personnel, including contractors and subcontractors conducting work at the site. The HASP used during site characterization activities may be amended to include excavation and restoration activities. The HASP should be prepared in accordance with the requirements of California Code of Regulations, title 8, section 5192 and all applicable federal, State and local laws, ordinances, and regulations and guidelines.

The HASP should at a minimum address the following:

- identification of activities being carried out, the associated risks, and the measures in place to prevent injury;
- names and titles of personnel in charge;
- emergency action plan;
- location of HASP (a copy should be on site at all times);
- on-site safety awareness training for all personnel for all field activities identified (e.g. tail gate meetings and frequency);
- identification of hazards (job hazard analysis) and requirements for documentation and correction of hazards;
- air monitoring requirements to identify and measure site contaminant concentrations generated during the soil removal and decontamination activities and guide the selection of personal protective equipment;
- appropriate personal protective equipment and safety systems for each site activity identified; and
- assurance that all workers comply with the rules to maintain a safe work environment (e.g., disciplinary methods for workers who fail to comply).

8.8 COMPLETION REPORT

The EDRP should briefly identify the key elements that will be covered in a work completion report[3] (completion report) along with the anticipated date of submittal. The completion report should be prepared in conformance with standard geologic and engineering principles and practices using appropriately licensed and experienced professionals. A link to an annotated outline for the completion report is provided in Appendix D. At a minimum, the report should provide the following:

- summary of the work performed;
- any difficulties or unexpected conditions encountered;
- deviations from the approved workplan;
- the results of post-excavation sampling (i.e., before backfilling and restoration) and compliance with performance standards;
- determination as to whether the RAOs were met;
- results of the post-excavation evaluation for cVOCs (if applicable, see Section 6.5);
- written and tabular summary of disposal activities;
- as-constructed drawings and results of post-restoration activities, if applicable;
- health and safety activities including any analytical results;
- compliance with all permit requirements;
- copies of permits for the project; and
- copies of signed manifests and bills of lading.

[3] The title of this document will vary depending on the cleanup process.

9.0 DESIGN AND IMPLEMENTATION OF SOIL VAPOR EXTRACTION ALTERNATIVE

For sites that have selected SVE as an interim response action or as part of the remedy, this chapter describes the approach that could be used to design and implement SVE systems for the remediation of cVOCs in a manner that achieves site-specific RAOs. The intent is to enhance the efficiency, but not replace, site-specific decisions made on the basis of individual site characteristics, applicable laws and regulations, and the principles of good engineering design. Appendix C supplements this chapter by providing additional considerations and resources for the design and implementation of SVE systems. Please recognize that this chapter and Appendix C are intended as guidance. All elements discussed may not be applicable to a given site.

The content of this chapter is largely based on, and specifically recommends the use of, the U.S. Army Corps of Engineers (USACE) *Engineering and Design - Soil Vapor Extraction and Bioventing, EM-1110-1-4001* (USACE Manual; USACE, 2002). Please note that the USACE Manual has been developed for all nature of sites and therefore addresses multiple technical issues that are not relevant to the PT&R approach for cVOCs.

This chapter may be used as a checklist of actions that may be required in the implementation of SVE systems. Applicable sections of the USACE Manual should be referenced for details. In addition, useful reference materials relating to SVE may be obtained from the USEPA or the Air Force Center for Engineering and the Environment (AFCEE) websites (www.clu-in.org; www.afcee.af.mil).

9.1 SITE CHARACTERISTICS FAVORABLE FOR EFFECTIVE SVE SYSTEMS

As discussed in Section 3.2, certain site conditions favor effective application of SVE for cleanup of cVOCs in vadose zone soils, including:

- relatively homogeneous, permeable soils
- relatively low moisture content soils
- adequate vadose zone thickness
- relatively small capillary fringe thickness
- cVOCs located above capillary fringe
- low soil organic carbon content
- volatile contaminants

9.2 GENERAL CONSIDERATONS FOR SVE IMPLEMENTATION

9.2.1 Remedial Action Objectives

SVE systems can be operated to achieve a variety of RAOs, including the following common examples:

- removing as much cVOC mass as feasible prior to application of other remedial technologies

- removing cVOC mass to decrease cVOC emissions during a subsequent soil excavation
- removing cVOC mass posing an on-going threat to groundwater
- controlling vapor flow / mass removal around a building having a potential vapor intrusion risk
- achieving health risk-based cleanup goals

The range in potential RAOs results in differences in the performance metrics that are used to evaluate the success of the SVE system and to determine when it is appropriate to shutdown the system. For some RAOs, the performance metric could be based on the estimated mass remaining in the subsurface and/or a mass removal rate. For other RAOs, the performance metric could be based on demonstrating achievement of numerical risk-based cleanup goals.

9.2.2 Transitioning from Interim Removal Action to Final Remedy

To provide near term reduction of cVOC mass posing a risk to human health, the environment, and/or groundwater, SVE is often implemented as an interim removal action (also referred to as an interim measure under some cleanup processes) taken prior to selection and implementation of the final remedy. The SVE system may or may not be included as part of the final remedy. For example, SVE may be excluded from the final remedy if site-specific RAOs are achieved during the interim removal action or if SVE proves ineffective for site conditions. For sites requiring on-going remediation of cVOCs in the vadose zone, SVE can be included in the alternatives analysis for the final remedy (see Section 7.2) and, if appropriate, selected as the final remedy.

9.2.3 Coordination with Groundwater Remedy

As illustrated by the DTSC study discussed in Section 7.1, cVOC releases commonly generate both soil vapor and groundwater plumes. Depending on site conditions, the soil vapor and groundwater plumes have the potential to interact during the cleanup action. Offgasing of cVOCs from groundwater can act as an on-going source of cVOCs to the vadose zone. Likewise, a vapor plume can continue to contribute cVOC mass to groundwater. The PT&R approach should be coordinated with the groundwater remedy so that cVOCs in groundwater do not recontaminate vadose zone soils and vice versa.

The SVE system may not be effective in removing contamination near the capillary fringe or water table because the higher moisture content decreases air permeability and inhibits cVOC mass removal. Where a significant mass of cVOCs occurs in the capillary fringe or near the water table, additional remedial measures that target this zone may be needed and/or the contamination may need to be addressed by the groundwater remedy.

9.2.4 Vapor Intrusion

SVE systems may be implemented to reduce or alleviate vapor intrusion into buildings. However, it is important to recognize that advective transport of cVOC vapors by SVE system operation potentially could direct cVOC vapors toward or beneath occupied buildings, and possibly affect the indoor air quality which might otherwise be unaffected. These potential effects should be considered during the system startup and in the operation and maintenance (O&M) plan. Permanent shallow soil vapor monitoring points adjacent to the buildings and/or beneath building foundations may be needed to assess the potential for the SVE system to affect indoor air quality.

The design and operation of the SVE system should be coordinated with vapor intrusion mitigation systems in nearby buildings (DTSC, 2009a). Consideration should be given to potential conflicting needs, infrastructure needs, and project schedules as well as the potential for SVE system operation to affect the performance of these vapor intrusion mitigation systems.

9.2.5 Licensure Requirements

SVE systems should be designed, built, installed, operated, and maintained in conformance with standard geologic, engineering, and construction principles and practices using appropriately licensed and experienced professionals.

9.3 SVE IMPLEMENTATION ELEMENTS

This section briefly describes the major elements of the SVE system design and implementation process. The section subheadings are generally consistent with headings in the USACE Manual which should facilitate finding the topic in the USACE Manual for further details.

9.3.1 Characterization and Technology Screening

The primary criteria in selecting SVE technology options are air permeability of the porous medium and volatility of the contaminants. Principal data needs include:

- nature and extent of contamination
- CSM
- soil matrix properties
- air permeability
- organic carbon content
- moisture content
- depth to groundwater
- thickness of capillary fringe

Other considerations are site conditions that may affect the SVE system design or performance (such as building locations, utilities, infrastructure, pavement, accessibility, etc.). Additional considerations for technology screening include cost, implementation, and regulatory constraints and objectives.

Because cVOCs are the main COC considered under the PT&R approach, the technology screening process focuses on the treatment options for the extracted soil vapors. Appendix C provides additional information regarding potential treatment options.

The qualitative and quantitative information obtained during site characterization (Section 4.2.2) and the evaluation of the applicability of the PT&R approach (Section 3.4) should be sufficient to determine whether it is appropriate to use SVE.

9.3.2 Pilot-Scale Testing for SVE System

Pilot-scale testing is performed as a means of gathering important design information and to determine field-scale air-flow behavior. This testing usually measures pressures, flow rates, contaminant concentrations, and other parameters during air pumping tests. Typically, the pilot-scale testing is conducted as a discrete activity with a specific pilot test workplan and pilot test report. However, on a case-by-case basis, DTSC may consider proposals to go directly to full-scale application (forgoing a discrete pilot-scale test phase) if:

- an adequate soil vapor monitoring network is constructed as part of the initial system design;
- the design plan includes provisions for future system modification based on operational data;
- the design plan includes a detailed strategy and procedures for system startup, testing, validation, and commissioning;
- a system validation and startup report (containing the information typically presented in a pilot-scale test report) is submitted after implementation of the system startup and proveout; and
- DTSC is consulted and concurs with the decision.

Basic activities during a pilot test (or equivalent system validation/startup testing) include:

- determine design data needs;
- develop testing strategy;
- prepare test plan (e.g., pilot-scale test workplan);
- test performance and data analysis; and
- prepare test report (e.g., pilot test report, system validation and startup report).

Considerations for pilot or system validation/startup testing include:

- documentation of operational vacuum parameters to define initial SVE system effectiveness;
- implementation of monitoring well infrastructure consisting of multi-depth, discrete interval monitoring wells

  - located at appropriate distances from extraction wells (e.g., wells located closer to and farther away from the expected zone of influence from the extraction well) and
  - discretely screened in both permeable and the most recalcitrant soils;
- construction of monitoring well infrastructure having dedicated polyvinyl chloride materials (typically two inch diameter) with appropriate screen intervals (typically a three foot minimum screen interval as opposed to tubing with a six inch screen); and
- construction and blower capacity to add wells to the SVE system should operational data indicate the need for additional extraction well capacity.

9.3.3 Design of Full-Scale SVE System

A full-scale SVE system should be designed to maximize the removal of cVOCs from the subsurface in the most efficient and timely manner. The following data should be collected, using appropriate DQOs, to support the design:

- speciated chemicals and total VOCs present in soil vapor
- properties of the target compounds in the soil vapor
- location of cVOCs in relation to the water table
- characteristics of soil in the zone of interest
- advective and diffusive rate-limiting factors in cVOC removal
- design airflow rate and flow path to remove the contaminants from the subsurface

The major components of the SVE design process include:

- SVE design strategy
- design basis (including SVE system objectives and performance metrics)
- well location (see Appendix C for recommendations regarding well placement)
- overall pneumatic considerations
- well construction
- piping, valves, and manifold system
- condensate control
- particulate filters
- blower silencers
- blowers and vacuum pumps
- instrumentation and process control
- electrical systems planning
- effluent treatment methods (see Appendix C for discussion of common methods),
- water and vapor condensate storage, treatment, and disposal methods (including secondary containment)
- SVE treatment system housing
- emissions monitoring / control
- local air permit requirements
- noise control

Some of these design components offer an opportunity to consider green remediation concepts. For additional discussion, see the *Interim Advisory for Green Remediation* (DTSC, 2009d).

9.3.4 SVE System Construction

SVE system construction entails installation of all SVE system infrastructure including vapor extraction wells, vapor monitoring wells, piping, controls, utilities, and treatment system components. The design plan should include a narrative description of the SVE system and should be supported by appropriate calculations, drawings, and figures. Refer to the USACE Manual for details of the following design elements:

- applicable USACE and USEPA design policy and requirements
- design document content (see also Section 9.4.3)
- system construction / construction oversight

Applicable permits (typically from the local air district) should be obtained prior to system construction and operation. A construction completion report should be submitted to DTSC documenting the full-scale SVE system (see Section 9.4.4).

9.3.5 System Startup and Commissioning

During the SVE system startup and commissioning phase, the SVE system is evaluated to determine whether the system has been constructed as designed, equipment is operating within specifications, and if any modifications are needed. In addition, initial performance data are collected and evaluated. Appendix C outlines considerations for initial optimization of the SVE system.

The major elements to be addressed by this phase include:

- collection of baseline vapor data in all extraction and monitoring wells prior to system startup;
- equipment shakedown and testing;
- if the pilot test phase is incorporated into the system validation/startup process, the data requirements identified in Section 9.3.2 should be collected;
- system start-up / full-scale optimization;
- basic monitoring protocols for the SVE system that can be carried forward into long-term operation of the system; and
- data evaluation.

The system startup and commissioning phase should be documented in a system startup and validation report (see Section 9.4.5).

The design plan should include an overall strategy for commissioning, shakedown, and start-up activities of the SVE system. A start-up plan (or procedure) should consider the design objectives and system complexity and should include:

- checklists for each component or parameter that will be tested;
- minimum number of hours that each system, operation, or parameter should be tested; and
- how each component or system should be tested (i.e., what measurements should be made).

At the end of the start-up phase, the entire SVE system should be operating normally according to specifications.

9.3.6 Operation, Maintenance, and Monitoring

An O&M plan should be developed for the SVE system. The plan should provide the O&M strategy, operational guidelines, monitoring strategy, and system modification and optimization considerations. The O&M plan should be as flexible as possible and should include contingencies for possible operational problems. The elements of an O&M plan include:

- O&M strategy
- system objectives and performance metrics
- monitoring (including DQOs for each type of monitoring activity)
- well maintenance
- SVE treatment system O&M considerations
- SVE treatment system operation schedule
- recordkeeping
- continued system evaluation to ensure achievement of RAOs
- optimization strategy for SVE system
- reporting requirements (e.g., status reports, notifications)

The O&M plan should address routine procedures for operation, maintenance, sampling, analysis, and system modification, as well as non-routine activities such as troubleshooting and shutdown. The design strategy, and the assumptions adopted in the design, should be included in the operational requirements of the system. In addition, the plan outlines the project needs, site considerations, and system design.

The O&M plan should include strategies and/or a decision process for optimizing or improving the performance of the treatment system. Examples of potential system optimization or performance improvement measures might include increasing the SVE well density, operating in a pulse mode (see Appendix C), operating only SVE wells that are removing significant cVOC mass, and measures to increase air flow in areas with the highest cVOC concentration. The O&M plan should also include criteria or a decision framework for initiating rebound assessment (see Section 9.3.7) and for permanent system shutdown (see Section 9.3.8).

The O&M plan should address the steps to be taken should performance assessments indicate that the SVE system is insufficient to achieve site-specific RAOs (such as when the design basis zone of capture was inadequate or when cVOC concentrations are persistently elevated after prolonged system operation). Inadequate performance assessments may warrant system modifications and/or re-design (including additional extraction well installation).

9.3.7 Rebound Assessment

Rebound assessment is conducted when cVOC concentrations measured in vapor monitoring wells and extraction well effluent (while the system is active) meet the RAOs, and mass removal has become negligible. At this point, the SVE unit is shut down for an appropriate timeframe (see next paragraph) to evaluate whether subsurface concentrations rebound or whether subsurface RAOs have been achieved.

The timeframe for rebound assessment is a site-specific determination. The assessment should be based on data collected over sufficient duration so that the measured soil gas concentrations represent a return to equilibrium conditions and thus are appropriate for determining whether the RAO is met. Some assessment timeframes exceed one year and therefore should be integrated into project plans, especially when contemplating redevelopment. For sites where the rebound assessment period is too long for the planned redevelopment schedule, one option is to reduce the amount of time to observe the rebound response by decreasing the spacing of the vapor monitoring wells.

If soil vapor concentrations indicate a need for further vadose zone remediation during the rebound evaluation period, vapor extraction wells that can influence such areas of the site or zones requiring additional cVOC removal are restarted. Extraction should continue until subsurface vapor concentrations approach RAOs. This cycle continues until: soil gas concentrations in all vapor monitoring wells and extraction well effluent remain below RAOs for an appropriate timeframe (see above); or it becomes apparent that RAOs cannot be attained through SVE, at which point the system could be evaluated for permanent shutdown (see Section 9.3.8).

Appendix C provides additional considerations for rebound assessment.

9.3.8 System Shutdown, Closure, and Cleanup Confirmation

The decision to permanently shutdown a SVE system should be based on data obtained from the treatment system influent as well as depth-specific soil gas data obtained horizontally and vertically throughout the baseline extent of the soil gas plume (i.e., the extent of the plume prior to initiation of the SVE system). The soil gas data can be collected from existing vapor wells and additional soil gas borings (if needed) to ensure adequate coverage of the baseline plume extent. Cleanup confirmation should be based on an appropriate number of sampling events, conducted over an appropriate timeframe (see discussion in Section 9.3.7), to demonstrate that residual cVOC concentrations are stable and achieve the RAOs. Appendix C provides additional discussion of system shutdown, closure, and cleanup confirmation.

The design plan or O&M plan should identify the data requirements and decision framework needed to determine whether the SVE treatment should be shutdown and site RAOs have been achieved. The main elements of SVE system shutdown and cleanup confirmation include:

- shutdown strategy;
- sampling and analysis;
- evaluation of results;
- long-term monitoring requirements;
- rebound assessment (see Section 9.3.7); and
- closure report.

9.4 SVE SYSTEM DOCUMENTS

This section describes various documents that may need to be submitted for DTSC review and approval during the process of evaluating, designing, implementing, and operating a SVE system. Some documents discussed in this section may not be needed for a given site. Documents in addition to those described in this section may also be needed. Each document should include title and signature pages (with appropriate signatures and stamps/licensure) and a table of contents. The documents should be prepared in conformance with standard geologic and engineering principles and practices using appropriately licensed and experienced professionals.

9.4.1 Pilot-Scale Test Workplan

A pilot-scale test workplan should be prepared that addresses the following elements:

- project description
- remedial technology description
- test objectives (including performance metrics)
- experimental design and procedures
- management and staffing
- equipment and materials
- sampling and analysis
- data management
- data analysis and interpretation
- health and safety
- waste management and regulatory compliance
- community relations and public participation strategy
- reporting
- schedule

Appendix C includes an annotated outline for a SVE system pilot-scale test workplan.

9.4.2 Pilot-Scale Test Report

A pilot-scale test report should be prepared that addresses the following elements:

- introduction
- background
- objectives (including performance metrics)
- equipment (including the experimental setup, vapor collection system, vapor treatment systems, and monitoring equipment)
- monitoring and data collection (chemical concentrations, temperature, pressure/vacuum, flow rate, etc.)
- departures from the workplan
- results and discussion of physical parameters (e.g., air permeability, vacuum/ pressure distribution, radius of effective air exchange, vacuum/flow rate correlation)
- results and discussion for chemical parameters (e.g., extracted soil vapor, residual soil, recovered condensate, chemical data quality, emissions)
- conclusions regarding overall effectiveness of SVE
- recommendations for further data collection
- appendices presenting the laboratory analysis reports, QA reports, field data sheets, and well installation and boring logs

Appendix C includes an annotated outline for a SVE system pilot-scale test report.

9.4.3 Full-Scale Design Document

A design document should be prepared for the full-scale SVE system. The timing and mechanism for submitting the design document is a site-specific decision. The design may be submitted to DTSC for review and approval as one document or as separate documents depending on project-specific considerations and process. Based upon project needs, submittal and approval of a "conceptual" plan may be necessary prior to submittal and approval of the final system engineering plans. The system design may require a phased approach (such as discrete pilot-scale testing, system validation, startup testing, and agency review) prior to final approval.

The design document should include the minimum content discussed in this section. Additional content may be required depending upon site-specific conditions and the subsurface cleanup objectives. For example, for sites choosing to forgo the discrete pilot test phase (see Section 9.3.2), the design document should include a detailed protocol for system startup and validation. The design document should also discuss other documents that may be required for its proper implementation.

- **Introduction.** Identify the project, the purpose of the document, and the regulatory-basis for the SVE system.

- **Project Background.** Provide an overview of the rationale for use of SVE, current and future land use considerations, COCs, and other general project considerations. If appropriate, this section should also indicate how the SVE system is integrated with other subsurface remediation and vapor intrusion mitigation efforts.

- **Site Conditions Summary.** Provide an overview of the CSM and other pertinent information along with references to other documents. This section may reference previous documents (e.g., current conditions report, summary reports) which contain more detailed discussion of site conditions. The CSM discussion should summarize the following:
  - site geology
  - previous sampling efforts
  - list of COCs and maximum detected soil gas concentrations
  - plume maps and cross sections
  - remediation efforts and RAOs
  - potential remediation treatment / degradation by-products
  - ambient air quality considerations
  - estimates of the degree of indoor air impacts (such as Johnson and Ettinger modeling results), if applicable

- **Cleanup Goals and Objectives.** Identify the performance metrics and contingency measures for the SVE system. Reference section(s) identifying how the goals and objectives will be monitored and tested. As applicable, identify general institutional control (IC) requirements and/or use restrictions (such as prohibited construction and restricted building modifications).

- **Design Basis.** Identify the design assumptions and criteria to be met by the SVE system.

- **Construction Methods.** Identify the construction methods to be used once the design has been approved, including:
  - construction specifications
  - minimum material specifications
  - installation procedures
  - construction QC procedures
  - post-installation testing procedures

- **Design Calculations and Drawings.** Include the design calculations and drawings for the SVE system, including the basis for the estimated zone of capture.

- **Conceptual Drawings.** Include conceptual drawings indicating building locations, prescribed building envelopes, streets, driveways, hard-scape areas, utility easements, well design and placement, and other infrastructure considerations.

- **Remediation Approach.** Provide a detailed description of the proposed remediation approach, including any phasing (tier approach) concepts (see Section 9.3.5). Also, provide the following information:

- technical basis for the design of the SVE system
- construction and implementation requirements
- any contingent systems which may be required
- component specifications and verification of ability to meet performance measures
- detailed testing procedures (including on-the-job instructions)
- system validation and startup strategy and procedures
- permit requirements from other agencies (such as a permit to construct and a permit to operate vapor treatment systems)
- SVE system shutdown and/or exit strategy
- reporting requirements
- applicable engineering drawings and system diagrams

- **Implementation Mechanisms.** Address the Land Use Covenant (LUC) requirements, deed restrictions, construction QA/QC, soil management , waste management, transportation, and emission control/monitoring.

- **Financial Responsibility.** Identify the applicable financial responsibility requirements.

- **Health and Safety Plan.** Include a worker HASP that addresses such topics as worker training requirements, protective gear, and monitoring procedures.

- **Operation and Maintenance Plan.** As an appendix or as a separate stand-alone document, include an O&M plan that details the O&M requirements, monitoring requirements, implementation mechanisms, and responsibilities for tasks and final obligations. See Section 9.3.6 for recommended O&M plan content.

Appendix C includes an annotated outline for a full-scale SVE design document.

9.4.4 Construction Completion Report

A completion report should be submitted to DTSC after the full-scale SVE system has been constructed. If applicable, the content of this report could be incorporated into a system validation and startup report (see Section 9.4.5). The report should include as-built drawings of system components, a brief account of field activities associated with system installation and startup, QA/QC data, and other appropriate content to document construction of the SVE system.

9.4.5 System Validation and Startup Report

A system validation and startup report should be submitted that, at a minimum, contains the following:

- introduction
- background
- objectives (including performance metrics)

- SVE system equipment description (layout, drawings, initial calculations, etc.)
- system startup summary (e.g., test results, well configuration, monitoring data, instrument and system settings, flow rates)
- system operations summary (e.g., permit changes, treatment system changeouts, blower operating parameters, O&M activities)
- monitoring and data collection (e.g., chemical concentrations, temperature, pressure/vacuum, flow rate)
- results and discussion of physical parameters (e.g., air permeability, vacuum/ pressure distribution, radius of effective air exchange, vacuum/flow rate correlation)
- results and discussion for chemical parameters (e.g., extracted soil vapor, residual soil, recovered condensate, chemical data quality, emissions)
- O&M reporting
- conclusions regarding overall effectiveness of SVE, including an interpretation of the zone of capture of the system
- recommendations for on-going system operations and data collection
- supporting appendices (e.g., laboratory analysis reports, QA reports, field data sheets, and well installation and boring logs)
- permit compliance on air emissions

Appendix C includes an annotated outline for a system validation and startup report.

9.4.6 Status Reports

Status reports summarizing the performance of the SVE system should be submitted to DTSC at a frequency identified in the O&M plan. Appendix C outlines suggested content for these reports.

9.5 COMPLETION REPORT

Once remediation has been completed and RAOs are achieved (see Section 9.3.8), a completion report should be prepared to verify and document the activities and results of the cleanup. The completion report should be prepared in conformance with standard geologic and engineering principles and practice using appropriately licensed and experienced professionals.

10.0 CERTIFICATION / COMPLETION

When the approved remedy for cVOCs in the vadose zone has been fully implemented, DTSC will confirm through review of performance metrics (including confirmation sampling) that the RAOs have been achieved. The possible determinations are:

- the RAOs have been achieved for cVOCs;
- the response action has been fully implemented, is operating successfully, and on-going O&M is needed until the RAOs are achieved; and/or
- additional cleanup is necessary.

Based on the findings, DTSC will issue a certification letter, a completion letter, or a letter requiring additional work to address cVOCs in the vadose zone.

10.1 SITE CERTIFICATION

When DTSC determines that the approved remedy has been fully implemented, DTSC certifies the satisfactory completion of remedial action activities at the site.

- When DTSC determines that the approved remedy has been fully implemented and the remediation for cVOCs in the vadose zone results in a site restored to unrestricted residential standards, DTSC certifies that the required remedy has been completed and that no further remediation is necessary, unless new information is obtained. The site status on DTSC's EnviroStor database is changed from "Active" to "Certified".
- If the site has been remediated to standards appropriate for restricted use of the property, DTSC issues a certification letter that the site soil has been restored to levels agreed upon in the regulatory decision document. The certification letter is issued after any requirements for a LUC and/or O&M agreement and O&M plan are met. The site status on DTSC's EnviroStor database is changed from "Active" to "Certified/Operation and Maintenance".
- If the approved remedy includes actions requiring operation, maintenance, and monitoring (e.g., SVE systems), DTSC certifies that the remedy has been implemented once: (1) sufficient information has been submitted to verify that the remedy has been implemented and is functioning as proposed in the remedy selection document and in design plans; and (2) any LUC, O&M agreement, and O&M plan requirements have been met. The DTSC certification letter will describe the remedy implemented and will state that DTSC has continuous oversight and the responsible party is required to operate and maintain the measures necessary for on-going protection of public health and the environment. The Site status on DTSC's EnviroStor database is changed from "Active" to "Certified/Operation and Maintenance".

10.2 COMPLETION LETTER FOR INTERIM ACTIONS / INTERIM MEASURES

Removal actions may be implemented as interim actions or interim measures taken to begin the cleanup process while the final remedy is being evaluated and selected. Examples of this include actions taken to reduce the mass of cVOCs in the vadose zone, or actions taken to address cVOCs in the vadose zone while remedies for groundwater are being evaluated. For these cases, the site is not ready for certification following the implementation of these actions. Hence, DTSC will issue a completion letter acknowledging that the PT&R removal action has been implemented and that additional actions are required to address cVOCs at the site.

10.3 ADDITIONAL ACTIONS NEEDED

Achievement of the RAOs outlined in the remedy decision document may not be possible. For these cases, DTSC will issue a letter acknowledging that the removal action was implemented, noting that the RAOs were not achieved, and requiring that the remaining contamination should be addressed through a subsequent response action.

11.0 LONG-TERM STEWARDSHIP

Long-term stewardship applies to sites and properties where long-term management of contaminated environmental media is necessary to protect human health and the environment over time. This includes sites where remediation may take place over several years and sites where contaminated media will remain in place for a much longer period of time. This chapter discusses elements that may be required to meet the needs of long-term stewardship. The elements included in below may not apply to all sites based on site-specific conditions and remedial timeframes.

11.1 INSTITUTIONAL CONTROLS FOR CONTAMINATION REMAINING IN PLACE

ICs are used to stop or reduce the exposure of human and environmental receptors to residual contamination. ICs are non-engineering mechanisms used to ensure that the intended future land use is consistent with site cleanup and engineering controls, and that these measures maintain their integrity and effectiveness.

For sites necessitating ICs, California Code of Regulations, title 22, section 67391.1 requires the property owner to enter into a LUC to ensure that DTSC will have authority to implement, monitor, and enforce the protective restrictions. LUCs allow on-going use of the property as long as the remedy is not compromised by current or future development. LUCs are intended to protect public health and the environment by preventing inappropriate land use, increasing the probability that the public will have information about residual contamination, ensuring that long-term mitigation measures are carried out by protecting the engineering controls and remedy, and ensuring that subsequent owners assume responsibility for preventing exposure to contamination. The LUC should provide for an annual inspection and annual report to ensure that the LUC continues to be protective. The LUC should also provide for preparation and submittal of five-year reviews.

LUCs may include soil management plans to ensure that soil is handled in such a way to prevent human and ecological exposure. These plans address soil excavation, soil stockpiling, stockpile characterization, soil disposal, soil reuse, construction dewatering, worker training, health and safety, and site inspection.

California Code of Regulations, title 22, section 67391.1 requires that a LUC imposing appropriate limitations on land use shall be executed and recorded with the local county recorder's office when hazardous materials, hazardous wastes or constituents, or hazardous substances will remain at the property at levels which are not suitable for unrestricted land use. The regulation requires DTSC to clearly set forth and define land use limitations or covenants in a remedy decision document prior to approving or concurring with any facility closure, corrective action, remedial or removal action, or other response actions. In addition to these regulatory requirements, it may also be prudent to coordinate with the local planning department regarding the LUC requirements. Further information regarding LUCs is available on the DTSC website.

After the LUC is recorded, if a proposed use of the property is inconsistent with the LUC requirements and/or would increase the risk of exposure to contaminants at the site,

additional actions must be conducted to ensure that the property meets cleanup standards appropriate for the proposed use. Additional sampling and risk characterization for further cleanup actions may be required, and the LUC may be rescinded or modified as appropriate.

11.2 REGULATORY OVERSIGHT AGREEMENT

A regulatory oversight agreement will be required for the period during which the SVE system is operated and until the site is certified. Examples include Corrective Action Consent Agreements and O&M Agreements.

11.3 OPERATION AND MAINTENANCE PLAN

Any regulatory oversight agreement should reference or include the DTSC-approved O&M plan that outlines the procedures and requirements for on-going O&M of the SVE system. Section 9.3.6 describes selected elements of an O&M plan.

11.4 CONTINGENCY PLAN

Any regulatory oversight agreement should reference or include a contingency plan that will be implemented in the event that an immediate response action is required to ensure protection of human health and the environment. Also, the contingency plan should address steps to be taken if performance assessment indicates that the removal action is insufficient and/or will not achieve the RAOs. The contingency plan may be a stand-alone document or may be included as an element of the O&M plan.

11.5 FINANCIAL ASSURANCE

Financial assurance can be accomplished by several mechanisms and will assure that sufficient monies are available to implement any required corrective action activities and on-going O&M activities, conduct necessary five-year reviews, and pay the regulatory oversight costs associated with those activities and IC implementation. These on-going costs should be included in the cost calculation utilized in the remedy selection process. The USACE Manual discusses considerations for estimating costs of constructing and operating SVE systems.

11.6 FIVE-YEAR REVIEW

The regulatory oversight agreement and the O&M plan should include provisions for conducting five-year reviews. The purpose of the five-year review is to ensure that the remedy remains protective of human health and the environment, is functioning as designed, and is maintained appropriately by O&M activities. The review generally addresses the following questions:

- Is the remedy functioning as intended?
- Are the cleanup objectives, goals, and criteria used at the time of cleanup alternative selection still valid?

- Have there been significant changes in the distribution or concentration of impacted soils at the site?
- Are modifications needed to make the remedy or the O&M plan more effective?

The five-year review may also include a remedy optimization evaluation (e.g., sustainability assessment), as discussed further in the *Interim Advisory for Green Remediation* (DTSC, 2009d).

The scope of the five-year review may be outlined in the O&M plan or in a separate workplan developed for a specific review. The following should be incorporated into the five-year review:

- notification of the community that the review is being conducted;
- inspection of the remedy;
- review of the data demonstrating the performance of the system;
- review of other components of the remedy; and
- preparation of a report that details the findings and recommendations of the review.

The *Comprehensive Five-Year Review Guidance* (USEPA, 2001a) may be a useful resource when conducting these reviews.

Depending on site-specific considerations, the inspection and/or technical assessment may be conducted by DTSC and/or the responsible party. DTSC will review the report and make recommendations, if necessary, to ensure that the remedy remains effective, to identify milestones toward achieving or improving effectiveness, and to provide a schedule to accomplish necessary tasks.

The five-year review report should be prepared in conformance with standard geologic and engineering principles and practice using appropriately licensed and experienced professionals.

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GLOSSARY

Brownfields. Brownfields are properties that are contaminated, or thought to be contaminated, and are underutilized due to perceived remediation costs and liability concerns.

Capillary fringe. Zone of soil immediately above the water table. The soil pores in this zone act like capillary tubes casing groundwater to rise within the pore. The water in this zone is retained under suction. At the base of the capillary fringe most soil pores are completely filled with water. At the top of the capillary fringe, only the smallest soil pores are filled with water.

CERCLA. The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA), commonly known as Superfund, was enacted by Congress on December 11, 1980, and amended in 1986, by the Superfund Amendments and Reauthorization Act (SARA). This law provided broad federal authority to respond directly to releases or threatened releases of hazardous substances that may endanger public health or the environment. CERCLA established prohibitions and requirements concerning closed and abandoned hazardous waste sites, provided for liability of persons responsible for releases of hazardous waste at these sites; and established a trust fund to provide for cleanup when no responsible party could be identified.

CEQA. The California Environmental Quality Act (Public Resources Code, §21000 et seq) requires public agencies to consider and disclose the environmental implications of their decisions, and to eliminate or reduce the significant environmental impacts of their decisions whenever it is feasible to do so.

Chemical of concern (COC). Chemicals of concern (COCs) are the compounds exceeding screening levels and are carried forward into the risk assessment.

California Human Health Screening Levels (CHHSLs). Developed by the Office of Environmental Health Hazard Assessment (OEHHA) as a tool to assist in the evaluation of contaminated sites to estimate the degree of effort that may be necessary to remediate a contaminated property. CHHSLs are concentrations of contaminants in soil, soil gas, or indoor air that the Cal/EPA considers to be below thresholds of concern for risks to human health.

Cleanup goal. Concentration value against which the success or completeness of a cleanup effort is evaluated.

Conceptual site model (CSM). Tool to help organize and communicate information about the site characteristics. It provides a summary of how and where contaminants are expected to move, and who might be exposed to chemicals and how it explains what a problem is and why a response is needed.

Corrective Measures Study (CMS). The Corrective Measures Study is the mechanism for the development, screening, and detailed evaluation of alternative corrective actions under the corrective action process.

Exposure point concentration (EPC). The exposure point concentration (EPC) is a conservative estimate of the average chemical concentration in the environmental media.

Feasibility Study (FS). Under the National Contingency Plan process (used by DTSC under California HSC Chapter 6.8), the feasibility study is the mechanism for the development, screening, and detailed evaluation of alternative remedial actions.

Hazard Index: Refers to the cumulative, noncarcinogenic health hazard estimate for a site.

HSAA. Hazardous Substances Account Act, Health and Safety Code, division 20, chapter 6.8.

HWCL. Hazardous Waste Control Law, Health and Safety Code, division 20, chapter 6.5.

Institutional Control (IC). ICs are actions, such as legal controls, that help minimize the potential for human exposure to contamination by ensuring appropriate land or resource use.

Interim Actions. Interim actions are short-term response actions performed pursuant to CERCLA or HSAA to control on-going risks while site characterization is underway or before a final response action is selected.

Interim Measures. Interim measures are short-term response actions performed pursuant to RCRA or HWCA to control on-going risks while site characterization is underway or before a final response action is selected.

Land Disposal Restriction (LDR). The Land Disposal Restriction (LDR) program found in federal and State regulations requires waste handlers to treat hazardous waste or meet specified levels for hazardous constituents before disposing of the waste on the land. To ensure proper treatment, the regulations establish a treatment standard for each type of hazardous waste. The regulations list these treatment standards and ensure that hazardous waste cannot be placed on the land until the waste meets specific treatment standards to reduce the mobility or toxicity of the hazardous constituents in the waste.

Land Use Covenant (LUC). Written instruments used to require compliance with certain obligations and restrict use of property. Land use covenants run with the land and are recorded at the county recorder's office so that they will be found during a title search of the property deed.

National Contingency Plan (NCP). The National Oil and Hazardous Substances Pollution Contingency Plan [40 Code of Federal Regulations sections 300.1 - 300.920], more commonly called the National Contingency Plan or NCP, is the federal government's blueprint for responding to both oil spills and hazardous substance releases.

Non-time-critical removal action. Non-time-critical removal actions, as defined by CERCLA, are removal actions that the lead Agency determines, based on the site evaluation, are appropriate, and a planning period of at least six months is available before on-site activities must begin.

Preliminary Endangerment Assessment (PEA). Under DTSC (2004), the Preliminary Endangerment Assessment (PEA) includes activities performed to determine whether current or past waste management practices have resulted in the release or threatened release of hazardous substances or materials which pose a threat to public health or the environment.

RCRA. The Resource Conservation and Recovery Act, an amendment to the Solid Waste Disposal Act to address the huge volumes of municipal and industrial solid waste generated nationwide. Under RCRA, USEPA has the authority to control hazardous waste from the "cradle-to-grave." This includes the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also sets forth a framework for the management of non-hazardous wastes. [Title 40 of the Code of Federal Regulations, Parts 239 through 282]

Remedial Action Plan (RAP). Under the HSAA, the RAP is the response action selection document for a remedial action for which the capital costs of implementation are projected to cost $2,000,000 or more.

Removal Action Workplan (RAW). Under the HSAA, the RAW is the response action selection document for a nonemergency removal action that is projected to cost less than $2 million at a hazardous substance release site. Typically, these are actions designed to stabilize or cleanup a site posing a threat to human health or the environment, either as an interim action or the final remedy.

Risk assessment: The scientific process used to estimate the likelihood that a chemical detected at a site may be harmful to people or the environment.

Risk management: The process of evaluating alternative regulatory and non-regulatory responses to risk and selecting among them. The selection process necessarily requires the consideration of scientific, legal, economic and social factors.

Risk screening. Process of identifying COCs that need to be cleaned up on the site based on potential risk to human health. Screening involves a comparison of site media concentrations with risk-based values (e.g., CHHSLs).

Screening level. Concentration value used to evaluate whether a cVOC poses a risk to human health and should be identified as a COC.

Site characterization. Process of determining the type, quantity, and location of contaminant releases at a site. Also includes assessment of site characteristics that affect how and where the contaminant may be moved and the how human health and the environment are or may be affected.

Soils. Loose material on the surface and in the subsurface of the earth consisting of solids (i.e., mineral grains, organic matter), water, and air.

Soil vapor. Air or gas phase compounds in soil pore spaces.

Soil vapor extraction (SVE). SVE is used to remediate vadose zone soil by applying a vacuum that induces the controlled flow of air to remove volatile and some semivolatile organic contaminants from the soil.

Time-critical removal action. Where a release or threatened release poses an imminent or substantial risk to health or environment and a timing period of less than six months exists, a time-critical removal may be employed to prevent a release of contaminants or minimize its risk. For these types of removal actions, evaluation and reporting requirements are kept to a minimum to expedite the response.

Vadose zone. The zone between the land surface and the top of the groundwater table. Water within this zone is referred to as soil moisture.

APPENDIX A
CONCEPTUAL SITE MODEL FOR CHLORINATED VOLATILE ORGANIC COMPOUNDS

This appendix presents the conceptual site model (CSM) for chlorinated volatile organic compounds (cVOCs) in the environment to illustrate potential contaminant migration pathways from a release point into subsurface soil and groundwater. The CSM presented herein is a simplified description of complex real-world systems and serves as a framework to illustrate the behavior of cVOCs so that appropriate characterization and remediation strategies can be developed. This appendix is meant to help practitioners visualize and interpret the spatial variability of cVOCs in the subsurface and to assist practitioners in developing site-specific CSMs. Figure A-1 illustrates the conceptual model for cVOC transport, as adapted from Rivett (1995).

Subsurface cVOC contamination is caused by releases from sources such as landfills, leaking pipes, underground storage tanks, aboveground spills, and aboveground facilities with operations that use chlorinated solvents. Such subsurface cVOCs may exist as contaminated soil gas, contaminated soil, non-aqueous phase liquid (NAPL) in soil or groundwater, and as dissolved-phase contamination in groundwater. NAPL contamination can be of particular concern due to higher contaminant concentrations and its persistence in the environment.

NAPL Plumes

After a liquid cVOC release, the NAPL may be fully contained in the vadose zone or may penetrate the water table to form NAPL pools below the water table as well as leaving a trail of residual NAPL along its migration pathway in both the vadose zone and saturated zone. NAPL may also accumulate near the water table if downward migration is slowed by conditions in the capillary fringe, hard pan zones, or other subsurface features. Where this occurs, subsequent water table fluctuations can produce a “smear zone” of residual NAPL that affects cVOC distribution in the vadose and saturated zones. The presence of these smear zones also affects the types of remedies that will be effective at a given site.

Because cVOC releases typically occur at or near the ground surface, transport mechanisms in the vadose zone are primarily responsible for soil gas and water table plume formation. As shown in Figure A-1, soil gas and water table plumes can have similar spatial footprints. NAPL present in, or close to, the saturated zone will produce dissolved-phase groundwater plumes. These groundwater plumes can have lengths greater than a thousand feet for dissolved-phase cVOC constituents that are not readily biodegradable. Dense NAPL can penetrate below the water table and migrate under the influence of gravity in directions opposite of groundwater flow. Accordingly, dense NAPL sources can be present in different places than would be expected by simply mapping the advective flow of groundwater alone, making sources difficult to find and delineate. Dissolved-phase plumes will emanate from the entire continuous, vertical distribution of NAPL in the groundwater (see Figure A-1).

Soil Gas Plumes

When released to the vadose zone, the cVOC vapors will migrate laterally by diffusion in all directions, potentially tens of meters away from NAPL sources (Silka, 1988; Mendoza and Frind, 1990). The cVOC vapors also will migrate upward toward the ground surface (possibly intruding into buildings) and downward toward the water table, contaminating groundwater by direct contact. Also, cVOCs in soil gas contaminate groundwater by partitioning into infiltrating recharge water within the vadose zone pore space. These processes produce water table plumes that are wide (relative to the groundwater flow direction) and spatially coincident with soil gas plumes.

As shown in Figure A-1, soil gas contamination can migrate laterally upgradient of the groundwater flow direction, potentially contaminating the water table upgradient of the source area. Consequently, in many cases, cVOC contamination detected in groundwater monitoring wells upgradient from release points may not be attributable to offsite sources. Rather, cVOCs in upgradient wells may be caused by lateral diffusional transport of contaminated soil gas followed by subsequent direct contact with groundwater or partitioning into infiltrating recharge water. Also, as groundwater flows away from cVOC sources areas, the dissolved-phase contaminants may partition from the aqueous-phase back into the vadose zone, contaminating soil gas. This soil gas contamination, which is further from NAPL sources than predicted by radial diffusional migration, may produce soil gas concentrations that pose a risk via the indoor air exposure pathway. Therefore, even distal portions of cVOC groundwater plumes located under residential or commercial buildings may produce unacceptable indoor air exposure scenarios.

Groundwater Plumes

The plan views in Figure A-1 illustrate the discrepancies in plume widths that should be recognized when delineating groundwater contamination in the saturated zone. Water table plumes are wide and spatially coincident with soil gas contamination. Deeper plumes will not be much wider than the NAPL source zone due to the weakness of transverse and horizontal dispersion (Anderson et al., 1992). These deeper groundwater plumes can avoid detection if sampling locations are spaced inappropriately. Practitioners should also recognize that saturated zones separated by aquitards may have different groundwater flow directions. Therefore, a deep groundwater plume may have a different spatial orientation than its associated water table plume.

Aquifer homogeneity should also be considered when developing a CSM. For saturated zones within relatively homogeneous subsurface conditions, deep NAPL sources generate narrow dissolved-phase contaminant plumes, and are expected to be directly under the cVOC release point. However, in aquifers within heterogeneous subsurface conditions, deep NAPL sources also may be laterally offset from the release point. For heterogeneous conditions, investigation efforts should assess contaminant distribution in both high and low permeability materials.

CSM Development

The CSM is a representation of the nature, extent, and fate of cVOCs that allows assessment of the potential exposures to contamination. Stakeholders use the CSM to evaluate strategies to protect public health and the environment. The CSM is a scientific hypothesis that is tested, modified, and refined until confident decision-making is possible. Typically, a CSM integrates subsurface characterization with a pathway-exposure assessment, and contains the following elements: contaminant sources; potential release mechanisms; affected environmental media; exposure pathways; and human and ecological receptors. The CSM is developed early and updated throughout the site characterization process. The CSM is a communication tool to direct risk-specific site sampling. Additional information for the development of a CSM can be found in USEPA (1996), USEPA (2008), and DTSC (2008).

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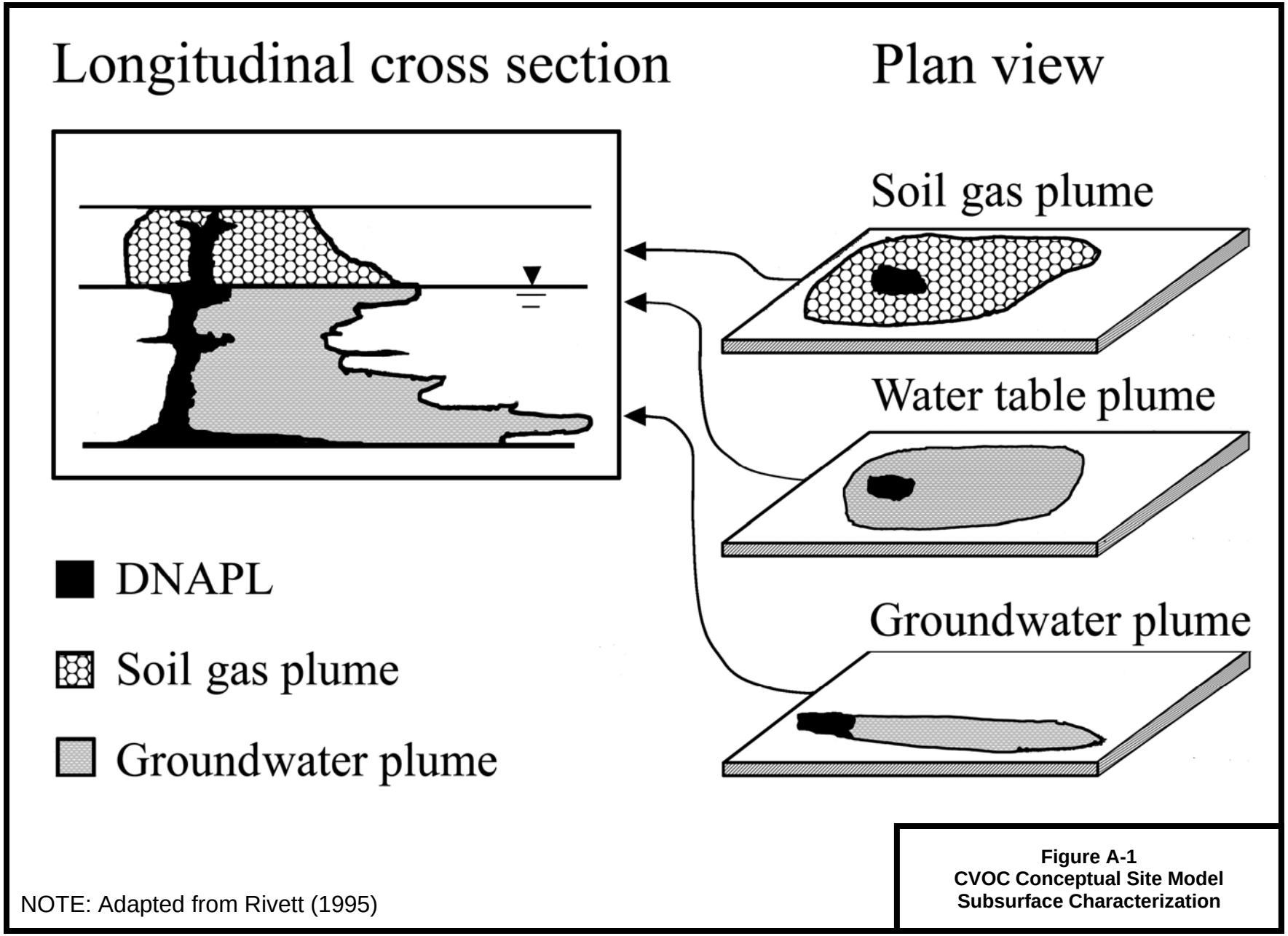

NOTE: Adapted from Rivett (1995)

**Figure A-1
CVOC Conceptual Site Model
Subsurface Characterization**

APPENDIX B

SUPPORTING DOCUMENTATION FOR DTSC TECHNOLOGY SCREENING

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Table B-1 Cleanup Options Selected for cVOCs in Vadose Zone Soil and Characteristics of Sites Evaluated by DTSC Study

DTSC Site Type (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Corrective Action (16[2])	1	14	0	6	0	0
Military Facilities (19[2])	3	12	0	6	2	0
Schools (3)	0	1	0	2	0	0
State Response/ NPL (33[2])	7	19	0	17	4	1
Voluntary Cleanup (19[2])	4	11	2	13	0	0

Total number of sites represented: 90

Depth to First Groundwater (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
≤ 10 feet bgs (9[2])	2	3	0	6	1	0
>10 to 20 feet bgs (13[2])	3	5	0	10	2	0
>20 to 50 feet bgs (25[2])	4	15	1	14	0	1
>50 to 100 feet bgs (16[2])	3	14	0	2	1	0
> 100 feet bgs (12[2])	1	12	1	3	0	0

Total number of sites represented: 75 (Information on depth to groundwater not available for all 90 sites.)

Affected Media (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Soil / soil vapor only (4[2])	1	2	0	3	1	0
Groundwater (86[2])	13	60	2	40	5	1
Surface water (1)	0	0	0	1	0	0
Indoor air (22[2])	5	22	0	7	0	0

Total number of sites represented: 90

Table B-1 (Continued)

Primary cVOCs Detected	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Trichloroethene	12	45	2	33	4	1
Tetrachloroethene	12	40	1	30	5	1
Trichloroethane	6	10	0	8	2	0
Dichloroethane	1	7	1	3	1	0
Chloroform	0	3	0	1	0	0
Methylene chloride	1	1	0	1	0	0
Carbon tetrachloride	1	3	0	0	0	0
Other	0	9	0	1	0	0

Total number of sites represented: 88 (Information detected cVOCs not available for all 90 sites.)

Contaminants Other than cVOCs	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
None reported	4	13	1	10	2	0
Metals	8	24	1	22	2	1
Fuel-related compounds, including BTEX	7	26	0	21	3	1
Semi-volatile organic compounds	3	10	0	4	1	1
Polynuclear aromatic hydrocarbons	0	7	0	5	0	1
Polychlorinated biphenyls	3	6	0	9	2	1
Pesticides	0	4	0	5	1	0
Dioxins/furans	0	3	0	1	0	0
Other	1	8	0	5	0	0

Total number of sites represented: 86 (Information on other contaminants present not available for all 90 sites.)

Table B-1 (Continued)

Historical Site Activity (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Manufacturing/ industrial activities (38[2])	3	25	0	21	1	1
Aircraft manufacturing, operations, maintenance (12[2])	3	8	1	3	0	0
Metal plating, finishing (8[2])	1	5	1	3	1	0
Dry cleaners (8[2])	1	4	0	4	1	0
Solvent recycling/ reclamation (5[2])	1	4	0	3	0	0
Disposal (10[2])	2	3	0	5	2	0
Equipment maintenance/ repair (3[2])	2	2	0	3	1	0
Research facility, laboratory (3[2])	0	3	0	1	0	0
Chemical distribution, packaging (3[2])	1	3	0	0	0	0

Total number of sites represented: 90

Current or Planned Land Use (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
Commercial/ industrial (55[2])	10	38	2	22	3	1
Residential, potentially residential, mixed use (15[2])	3	7	0	13	1	0
School/ church (4[2])	0	2	0	3	0	0
Natural area (1)	0	1	0	0	0	0

Total number of sites represented: 75 (Information on potential future use not available for all 90 sites.)

Table B-1 (Continued)

Site Size (no. of sites)	Cleanup Option Selected (No. of Sites)					
	IC[1]	Soil Vapor Extraction	*In Situ* Treatment Technologies	Excavation & Off-site Treatment/ Disposal	Containment/ Capping	Excavation, *Ex Situ* Treatment, On-site Reuse
≤1 acre (15[2])	2	8	0	10	1	0
>1 – 10 acres (38[2])	7	23	2	21	2	0
>10 – 50 acres (19[2])	3	13	0	9	1	0
>50 – 100 acres (3)	0	1	0	1	0	1
> 100 acres (2[2])	1	1	0	0	1	0

Total number of sites represented: 77 (Information on site size not available for all 90 sites.)

Notes:
bgs below ground surface
BTEX Benzene, toluene, ethylbenzene, xylene
cVOCs chlorinated volatile organic compounds
NPL National Priorities List
1 IC is institutional control. Used in conjunction with another cleanup option.
2 Some sites in this category selected multiple cleanup options (i.e., this number is not simply the sum of frequencies listed in this row).

Table B-2 Technologies Applicable at Sites with Chlorinated VOCs in Vadose Zone Soil

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***Ex Situ* Technologies**[1]				
Excavation and Off-site Disposal	Impacted soil is excavated and isolated within an engineered disposal unit (e.g., landfill, CAMU).	• Wide variety of soils and contaminants.	• Cost. • Transportation of impacted soils to off-site disposal facility. • Does not lessen toxicity, mobility, or volume of hazardous wastes.	
Capping	Impacted soil is isolated in place beneath an engineered cap or excavated and isolated within an engineered disposal unit (e.g., landfill, CAMU).	• Wide variety of soils and contaminants.	• Long-term maintenance. • Land use restrictions. • Not protective if groundwater is shallow. • Likely will require a gas collection system to control contaminant vapor migration. • By itself, cannot prevent the horizontal flow of water through the waste, can only reduce the vertical entry of water into the waste.	
Slurry Phase Bioremediation	Slurry-phase bioreactors are used to treat halogenated VOCs using cometabolites and specially adapted microorganisms. Slurry is created by combining soil with water and other additives and mixing to keep solids suspended and microorganisms in contact with the soil contaminants. Upon completion of treatment, the slurry is dewatered and treated soil is disposed of.	• Favored over *in situ* biological treatment for -heterogeneous soils, -low permeability soils, -areas where underlying ground water would be difficult to capture, or -when faster treatment times are required.	• Less reliable for treatment of cVOCs than other *ex situ* biological treatment options. • Requires bench and pilot scale studies. • Difficulty and cost of sizing materials prior to placement in reactor. • Nonhomogeneous and clayey soils can create materials handling problems. • Must remove free phase contaminants prior to treatment. • Cost of dewatering soil fines after treatment. • Requires acceptable method for disposing of nonrecycled wastewaters.	2, 5

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***Ex Situ* Technologies[1]**	**(Continued)**			
Biopiles	Excavated soils are mixed with soil amendments, placed in aboveground enclosures, and subjected to aerated bioremediation and composting process. Treatment units typically require liner, pad, leachate collection system, and aeration system.	• Can treat some cVOCs, though most commonly used to treat fuel-related compounds.	• Requires bench and pilot scale studies. • Questionable effectiveness for halogenated compounds in soil. • Volatile constituents tend to evaporate rather than biodegrade during treatment. • May require air emission controls. • May result in less uniform treatment than processes involving periodic mixing.	2, 3, 5
Landfarming (also known as Land Treatment)	Excavated soil is amended and applied into aboveground beds that are periodically turned over or tilled to aerate the soil. Treatment units typically require a liner and berms, and potentially a leachate collection system.	• Treating aerobically degradable, non-volatile contaminants. • Can treat some cVOCs, but most successfully used for treating petroleum hydrocarbons.	• Requires bench and pilot scale studies to verify that technology can meet RAOs. • May not be best treatment option for cVOCs based on cost and effectiveness. • Harder to degrade organic compounds having a higher degree of chlorination. • Concentration reductions greater than 95% and constituent concentrations less than 0.1 ppm are difficult to achieve. • Volatile constituents tend to evaporate rather than biodegrade during treatment. • Likely will require emission controls. • Difficult to control conditions affecting biological degradation (e.g., temperature, moisture). • Large amount of space is required.	2, 4, 5

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***Ex Situ* Technologies[1]**	**(Continued)**			
Composting	Controlled biological process which treats organic contaminants under thermophilic conditions (54 to 65° C). Contaminated soil is excavated and mixed with bulking agents and organic amendments. Three common designs include aerated static piles, in-vessel, windrow composting.	• Soils contaminated with biodegradable organic compounds.	• Substantial space is required. • Amendments cause volumetric increase. • Off-gas control and treatment may be required. In-vessel composting provides the best control of VOCs. When a vacuum is applied, aerated static piles offer some control of VOCs. • Most costly *ex situ* biological treatment option. • Design requirements (e.g., need for liner, aeration method, temperature) depend on type of design.	2, 5
Chemical Extraction	Contaminated soil and an extractant (e.g., solvent, acid) are mixed in an extractor. Extracted solution is separated into contaminants and extractant for treatment and further use. Physical separation steps are often used before chemical extraction to grade the soil into coarse and fine fractions (assuming much of contaminant is associated with fine fraction).	• Shown to be applicable for separation of organic contaminants such as in paint wastes, synthetic rubber process wastes, and petroleum refinery oily wastes. • Commercial-scale units are in operation, varying in regard to extractant employed, type of equipment used, and mode of operation. • Commonly used in combination with other technologies, such as solidification/stabilization, incineration, or soil washing.	• Some soil types and moisture content levels will adversely impact process performance. • Higher clay content may reduce extraction efficiency and require longer contact times. • Capital costs can be relatively high. • May be more economical at larger sites. • Extractant effects (e.g., acidity, toxicity) on treated soil may need to be addressed. • Less reliable than other *ex situ* physical/ chemical treatment options. • Typically requires longer cleanup time than other *ex situ* physical/ chemical treatment options.	2

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***Ex Situ* Technologies[1]**	**(Continued)**			
Dehalogenation	Soil is screened, processed with a crusher and pug mill, and mixed with reagents. Mixture is heated in a reactor. Replaces halogen molecules or causes decomposition and partial volatilization of contaminants.	• Typically used for halogenated SVOCs and pesticides. • Can be used to treat some halogenated VOCs. • Can be used for small-scale applications	• Generally more expensive than other technologies. • Concentrations of chlorinated organics greater than 5% require large volumes of reagent. • High clay and moisture content will increase treatment costs. • Capture and treatment of residuals may be difficult, especially when the soil contains high levels of fines and moisture.	2
Thermal Desorption	Soil is heated to volatilize water and organic contaminants. A carrier gas or vacuum system transports volatilized water and organics to the gas treatment system.	• Full spectrum of organic contaminants, including VOCs.	• May be less cost-effective than other treatment technologies. • Incidental combustion may occur in some thermal treatment units. • Emission controls and permitting requirements. • Particle size and materials handling requirements can impact applicability or cost at specific sites. • Dewatering may be necessary to achieve acceptable soil moisture content levels. • Clay and silty soils and high humic content soils increase reaction time.	2, 4
Incineration	High temperatures, 870-1,200 °C, are used to combust (in the presence of oxygen) organic constituents in hazardous wastes.	• Used to remediate soils contaminated with hazardous wastes, particularly chlorinated hydrocarbons, PCBs, and dioxins.	• Typically requires transport of impacted soils over long distances. • High cost and energy usage. • Feed size and materials handling issues can impact applicability or cost. • Off gases and combustion residuals generally require treatment.	2

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***In Situ* Technologies**				
Soil Vapor Extraction (SVE)	Vacuum is applied through extraction wells to create a pressure/concentration gradient that induces gas-phase volatiles to be removed from soil via extraction wells.	• Volatile compounds. • Often promotes *in situ* biodegradation of low-volatility organic compounds. • Can remove contamination under existing structures.	• Higher vacuums required for soil with high percentage of fines or high degree of saturation, increasing costs and/or limiting effectiveness. • May be less effective in heterogeneous soil. • Reduced removal rates for high organic content or extremely dry soils. • Exhaust air may require treatment. • Residual liquids from off-gas treatment may require treatment/disposal. Spent activated carbon will require regeneration or disposal. • Not effective in saturated zone. • May not be able to address shallow VOC sources because of short circuiting. • Subsurface infrastructure (e.g., pits, vaults) may limit treatment effectiveness.	2, 6
Thermally Enhanced SVE	Heating is used to increase volatilization rate and facilitate extraction. Heating options include conductive heating, steam/hot air injection, and electrical resistance/ electromagnetic/fiber optic/radio frequency	• Option for treating VOCs if high moisture content is limiting the effectiveness of standard SVE.	• Same as for SVE. • Tight or high moisture content soil has reduced air permeability and requires more energy input to increase vacuum and temperature. • Soil with highly variable permeabilities may result in uneven delivery of gas flow to contaminated areas. • Hot air injection has limitations due to low heat capacity of air.	2

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***In Situ* Technologies**	**(Continued)**			
Thermal Desorption	Applies heat to impacted soil by *in situ* methods. Heat can destroy or volatilize organic chemicals. As chemicals change into gases, mobility increases, and gases can be extracted and treated in an *ex situ* treatment unit. Similar heating options as thermally-enhanced SVE.	• Used with a wide range of soil types and volatile contaminants. • Can remove contamination under existing structures.	• Uncertainty about uniformity of treatment because of variability in soil characteristics and because process efficacy is difficult to verify. • High utility costs.	2
Cometabolic Bioventing	Air and a volatile organic substrate (e.g., propane) are delivered to contaminated unsaturated soils by forced air movement to elicit production of monooxy-genase enzymes which consume the organic substrate and facilitate contaminant degradation.	• Lightly chlorinated compounds in vadose zone.	• Limited experience with technology, particularly with cVOCs. Requires bench scale and pilot testing to demonstrate effectiveness for a given site. • Difficulty of distributing gases in subsurface. • May be difficult to apply to shallow contamination.	5
Anaerobic Bioventing	Nitrogen and an electron donor (e.g., hydrogen, carbon dioxide) are delivered to contaminated unsaturated soils by forced air movement (injection) to produce reducing conditions, thereby facilitating microbial dechlorination.	• May be useful in treating highly chlorinated compounds.	• Emerging technology. Requires bench, pilot, and field demonstrations to confidently apply this technology. • Difficult to distribute gases in subsurface. • Design must compensate for poor permeability conditions. • May be difficult to apply to shallow contamination.	5

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***In Situ* Technologies**	**(Continued)**			
Soil Flushing	Water, or water containing a solubility-enhancing additive (e.g., surfactant), is applied to soil or injected into ground water to raise water table into contaminated soil zone. Contaminants are leached into ground water, which is then extracted and treated.	• Can be used to treat VOCs, but may be less cost-effective than other technologies.	• Potential for washing contaminant beyond capture zone. Should be used only where flushed contaminants and soil flushing fluid can be contained and recaptured. • Water quality concerns with introducing surfactants to subsurface. • May alter the physical/chemical properties of the soil system (e.g., effective porosity). Can reduce contaminant mobility. • Low permeability or heterogeneous soils are difficult to treat. • Aboveground separation and treatment costs for recovered fluids can drive the economics of the process.	2
Chemical Oxidation	Chemically converts contaminants to non-hazardous or less toxic compounds that are more stable, less mobile, and/or inert. Rate and extent of degradation of target compound are dictated by its chemical properties and susceptibility to oxidative degradation. Matching the oxidant and *in situ* delivery system to contaminants and site conditions is key to successful implementation and achieving performance goals.	• Capable of achieving high treatment efficiencies for cVOCs over short time periods.	• Potential contaminant mobilization. If applied to vadose zone soils, need to address mobilization of contaminants and oxidation byproducts to groundwater. • Requires bench and pilot scale studies. • Oxidant delivery problems due to reactive transport and soil heterogeneity. • Short persistence of some oxidants due to fast reaction rates. • Natural oxidant demand may be high for some soils (e.g., high organic matter content, high reduced minerals, carbonates, free radical scavengers). • Potential permeability reduction. • Health and safety concerns with handling strong oxidants.	2, 7

Table B-2 (Continued)

TECHNOLOGY	DESCRIPTION	APPLICABILITY	LIMITATIONS / CONSTRAINTS	REF.
***In Situ* Technologies**	**(Continued)**			
Phytoremediation	Process that uses plants to remove, transfer, stabilize, and destroy contaminants in soil and sediment.	• May be applicable for remediation of cVOCs in shallow soils.	• Depth of treatment zone is determined by plants used in phytoremediation. In most cases, it is limited to shallow soils. • Treatment effects may be seasonal. • Longer cleanup time than other technologies. • Can transfer contamination across media, e.g., from soil to air.	2, 8

1 *Ex situ* technologies assume excavation of soil prior to application of technology
2 Van Deuren and others (2002)
3 USEPA (2004)
4 ITRC (1997)
5 USEPA (2006)
6 USACE (2002)
7 Huling and Pivetz (2006)
8 USEPA (2005)

Table B-3 Evaluation of Technologies Applicable to Sites With Chlorinated VOCs in Soil Against National Contingency Plan Analysis Criteria

TECHNOLOGY	NCP CRITERIA						
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	LONG-TERM EFFECTIVENESS	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Institutional Controls	• **Manages potential exposure by restricting access and future land use.**	• May not comply with ARARs.	• Uncertain because does not permanently address contamination.	• Not a treatment alternative.	• Does not create risks during implementation	• Easily implemented.	• Typically the lowest cost alternative.
Excavation and Off-site Disposal	• Protectiveness achieved by cVOC removal from site.	• Requires compliance with applicable State and federal requirements for waste handling, storage, transportation and disposal requirements.	• High long-term effectiveness for site. • Protectiveness at disposal site dependent on off-site management choices.	• Disposal reduces mobility. • Reduction in toxicity and volume depends on offsite management choices.	• Requires standard precautions necessary for protection of human health and environment during excavation, transport, and disposal. • **cVOC emissions may require control during excavation and handling.**	• **Easily implemented for shallow soils, if feasible site logistics**, and facility with adequate capacity for waste type, located within a reasonable distance of site. • Uses standard construction equipment and labor.	• Usually reasonable for small to medium volumes of contaminated soil. • May be **cost-prohibitive** for large volumes.

Note: Bold indicates major reason(s) rejected during alternatives analysis for sites evaluated by DTSC Study (see Chapter 7 of main text).

Table B-3 (Continued)

TECHNOLOGY	NCP CRITERIA						
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	LONG-TERM EFFECTIVENESS	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Soil Vapor Extraction (after USEPA, 1993)	• Provides short-term and long-term protection by reducing concentration and exposure to cVOCs in soil. • Depending on site-specific conditions, prevents or decreases further groundwater contamination.	• Does not trigger land disposal requirements. • Because of limited disturbance, few impacts to water and sensitive resources are likely. • Potential to treat cVOC concentrations to levels that will prevent exceedance of groundwater cleanup levels. • Emission controls are needed to comply with air quality standards.	• Effectively removes contamination source. • **Proven technique for removing cVOCs from soil at depths with adequate air permeability.** • Requires some treatment of residuals. • Requires review during on-going operation. • Periodic reviews may be required if residual levels of cVOCs remain after system shutdown.	• Significantly reduces toxicity, mobility, or volume through treatment or removal of cVOCs. • Produces few waste streams.	• Potential air emissions easily controlled. • Generally involves relatively short timeframe to achieve RAOs. • Effective for treating cVOC mass under buildings. Can be performed on active sites. • Equipment is readily available.	• Readily available technology. • Proven technology. • Requires few engineering controls. • Requires soil gas sampling to monitor cleanup progress and demonstrate achievement of RAOs.	• Can be cost effective.

Note: Bold indicates major reason(s) rejected during alternatives analysis for sites evaluated by DTSC Study (see Chapter 7 of main text).

Table B-3 (Continued)

TECHNOLOGY	NCP CRITERIA						
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	LONG-TERM EFFECTIVENESS	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Containment by Capping	• Contaminated soil remains in place. Depending on site conditions, **cVOCs may migrate laterally and vertically beneath cap unless controlled.** • Risk of exposure through inhalation, dermal contact and/ or incidental ingestion reduced through barriers. • **Groundwater protection** depends on depth to water, potential for cVOC migration, and cap design that reduces water migration through soil.	• Waste disposal requires compliance with ARARs.	• Long-term protection ensured through **continued cap maintenance, ICs, and, if needed, emissions controls.**	• **Not a treatment alternative.**	• Requires standard precautions for protection of human health and environment.	• Commercially available. • Demonstrated technology. • Necessary materials easily attainable. • Uses standard construction equipment and labor.	• Generally less expensive than most forms of treatment.

Note: Bold indicates major reason(s) rejected during alternatives analysis for sites evaluated by DTSC Study (see Chapter 7 of main text).

Table B-3 (Continued)

TECHNOLOGY	NCP CRITERIA						
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	LONG-TERM EFFECTIVENESS	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
In Situ Treatment	• Protectiveness achieved by transforming cVOCs and achieving target cleanup levels. • **Potential for cVOC mobilization to groundwater.**	• Requires compliance with applicable State and federal requirements for treatment process.	• Permanently destroys cVOCs, if reagent successfully placed in contact with impacted soils. • **Uncertain effectiveness.** • **Some technologies unproven for cVOCs in unsaturated soils.** • **Some technologies can be effective for specific cVOCs.**	• Reduces toxicity, mobility, and volume of soil contaminated with cVOCs.	• Requires standard precautions for protection of human health and environment during treatment process (e.g., reagent handling).	• Assess applicability through bench scale and treatability studies. • May require permit for treatment process. • Equipment availability depends on selected treatment process. • **Time to treat.** • Some treatments require large power source. • **Ability to achieve geochemical conditions needed for treatment.**	• Relatively high **cost**.

Note: Bold indicates major reason(s) rejected during alternatives analysis for sites evaluated by DTSC Study (see Chapter 7 of main text).

Table B-3 (Continued)

TECHNOLOGY	NCP CRITERIA						
	OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT	COMPLIANCE WITH APPLICABLE OR RELEVANT AND APPROPRIATE REQUIREMENTS	LONG-TERM EFFECTIVENESS	REDUCTION OF TOXICITY, MOBILITY, OR VOLUME THROUGH TREATMENT	SHORT-TERM EFFECTIVENESS	IMPLEMENTABILITY	COST
Ex Situ Treatment	• Protectiveness achieved by treatment in above-ground units and achieving cleanup goals for on-site reuse or for land disposal.	• Requires compliance with applicable State and federal requirements for excavation, treatment transportation, storage, and disposal. • Emission controls likely needed to comply with air quality standards.	• **Some techniques can be effective for specific cVOCs.** • **May require additional technology if cleanup goals not achieved.**	• Removes cVOCs or transforms cVOCs to less toxic by-products.	• Potential short-term risks from emissions during excavation, treatment, soil handling, and transportation. • Requires standard precautions for protection of human health and the environment during treatment process.	• **May require bench and pilot scale studies.** • May have multiple treatment steps. • **On-site treatment requires space for treatment unit.** • **Off-site treatment requires transport to treatment facility.** • Administrative requirements for permitting treatment unit may delay project.	• Relatively high **costs,** particularly for off-site treatment and disposal.

Note: Bold indicates major reason(s) rejected during alternatives analysis for sites evaluated by DTSC Study (see Chapter 7 of main text).

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APPENDIX C

RESOURCES FOR DESIGN AND IMPLEMENTATION OF SVE SYSTEMS

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ACRONYMS AND ABBREVIATIONS

Cal/EPA	California Environmental Protection Agency
CEQA	California Environmental Quality Act
cm/s	centimeters per second
CSM	conceptual site model
cVOC	chlorinated volatile organic compound
DQO	data quality objective
DTSC	California Department of Toxic Substances Control
GAC	granular activated carbon
GRA	Groundwater Resources Association of California
LARWQCB	Los Angeles Regional Water Quality Control Board
LEL	lower explosive limit
O&M	operation and maintenance
PT&R	proven technologies and remedies
QA	quality assurance
QC	quality control
QAPP	quality assurance project plan
RAO	remedial action objective
ROI	radius of influence
SVE	soil vapor extraction
SVM	soil vapor monitoring
USACE	U.S. Army Corps of Engineers
USEPA	U.S. Environmental Protection Agency

Preface

This appendix supplements Chapter 9 of this guidance document by providing additional information about selected topics for soil vapor extraction (SVE) systems. The intent is to facilitate the design and implementation of SVE systems. Please refer to the main text of this guidance document for an overall discussion of the design and implementation of SVE systems as well as discussion of site characterization, cleanup technology screening and evaluation, and remedy selection. Please recognize that this appendix and Chapter 9 are intended as guidance. All elements discussed may not be applicable to a given site.

1.0 TREATMENT TECHNOLOGIES FOR SVE SYSTEM EFFLUENT

This discussion summarizes the likely treatment methods for SVE system effluent. A comprehensive discussion of the engineering design of air emission control devices is beyond the scope of this PT&R guidance and would duplicate information in *Engineering and Design - Soil Vapor Extraction and Bioventing* (USACE Manual; USACE, 2002) and *Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice* (USEPA, 2006). Off-gas treatment systems may not be necessary for a given SVE system if emissions are below regulatory levels or health-based goals (health risk analysis).

1.1 GENERAL OBJECTIVE OF EFFLUENT TREATMENT

Effluent treatment methods need to be designed to treat a wide range of volatile chemicals and concentrations. Chlorinated volatile organic compound (cVOC) concentrations can span several orders of magnitude between system startup and shutdown, and therefore the effluent treatment system must operate properly for the anticipated concentration ranges. The consequences of the treatment process itself must be considered in selecting the construction materials. Disposal of residuals such as spent carbon and condensate must also be addressed. The following considerations are needed for design of effluent treatment systems:

- initial and long-term concentration ranges
- complete analysis and speciation of the influent gas
- total flow rate range
- required removal efficiency
- availability of utilities
- required degree of control, monitoring, and automation
- noise generation
- condensate control and proper management (e.g., secondary containment)

Additional case-specific considerations may be applicable, such as local agency air emissions requirements or California Environmental Quality Act (CEQA)-identified

mitigation needs. Communication between the designers of the subsurface and aboveground components is essential.

1.2 TYPICAL EFFLUENT TREATMENT OPTIONS

Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice (USEPA, 2006) provides detailed discussion of effluent treatment options for cVOCs, including thermal treatment, adsorption, and emerging technologies such as vapor condensation. This section discusses treatment technologies used by the majority of Department of Toxic Substances Control (DTSC) projects, namely granular activated carbon (GAC) and thermal treatment. Experience on DTSC projects has found that GAC is often the chosen method of treatment even though thermal treatment may be the most efficient and cost effective approach. Thermal treatment may be the best option for waste streams containing vinyl chloride because vinyl chloride does not adsorb onto GAC. Ketones, methane, chlorofluorohydrocarbons, and sulfur-containing compounds are examples of other compounds that are not suitable for GAC treatment.

1.2.1 Sorbents

Sorbents can remove many classes of organic compounds including aromatic, aliphatic, and halogenated hydrocarbon compounds. Adsorption of volatile contaminants occurs via chemical and physical attractive forces between liquid or gas phase molecules and the molecules of the solid sorbent activated carbon, zeolites, or synthetic polymers. Selection of an appropriate sorbent material is primarily a function of the contaminant to be adsorbed. Activated carbon is the most widely used adsorbent material and is the focus of the remainder of this discussion.

Many SVE systems utilize GAC in flow-through canisters which are relatively simple to operate when properly designed. A carbon adsorption design usually includes multiple columns which are operated either in series or in parallel. The series arrangement is generally operated so that the secondary and subsequent columns (if applicable) act as a backup when breakthrough occurs on the primary canister. When the lead column is removed from service, the lag column is moved up to the lead position and the new column (or regenerated column) is installed in the lag position. The pressure / temperature ratings of the GAC canisters must exceed the anticipated operating conditions of the SVE system equipment.

Adsorption is normally a reversible process. Under suitable conditions the materials that have accumulated in the carbon can be desorbed and the carbon can be re-used. Thermal reactivation is the most widely used regeneration technique. In SVE systems where carbon usage is low, on-site regeneration will not be cost-effective and the spent carbon should be either disposed of or regenerated offsite. For larger long-term SVE systems, onsite regeneration should be considered based on a complete life-cycle cost economic analysis. If possible, the designer should estimate the total carbon usage for the life of the project and compare the carbon cost with the capital and operation and maintenance (O&M) cost of the regeneration system. A similar economic analysis could be performed for comparison with catalytic and thermal oxidation, as discussed below.

1.2.2 Thermal Oxidation

The four general types of thermal oxidation systems available for controlling cVOC emissions include:

- direct flame thermal oxidizers
- "straight-through" flameless thermal oxidizers
- regenerative thermal oxidizers
- catalytic oxidizers

Although each type of system operates somewhat differently, the primary goal of thermal oxidation is to raise the temperature of the gas stream to a sufficient level to promote oxidation (or combustion) of the contaminant to carbon dioxide and water. The heat for thermal oxidation comes from heat input to the oxidizer in the form of supplemental fuel (either gas or electric) as well as from the heating value content (usually in British thermal units) of the cVOCs in the SVE vapor streams. In-line flame arrestors should be incorporated into the design when using thermal oxidizers. Placed just upstream of thermal oxidizers, flame arrestors can prevent fire from moving through piping, and can protect other parts of the SVE system from fire or explosion.

Issues to be considered when evaluating thermal oxidation options include:

- cost savings that can be achieved by heat recovery techniques
- adjustment of the amount of auxiliary fuel (or dilution air) to accommodate variations in mass loading
- for catalytic oxidation, consideration of the catalyst type and catalyst limitations (e.g., deactivators, overheating, lifespan)
- generation and treatment of acidic emissions (i.e., gases, liquids)
- potential generation of products of incomplete combustion (e.g., chlorinated dibenzo-p-dioxins, chlorinated dibenzofurans)
- lower explosive limit (LEL) of the waste stream[1]

Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice (USEPA, 2006) provides guidance on selecting a thermal treatment technology.

[1] The LEL is defined as the minimum concentration of chemical vapor in atmospheric air (i.e., 21% oxygen and at 20°C) that is sufficient to support combustion.

2.0 VACUUM, FLOW, AND ZONE OF CAPTURE ASSESSMENTS

2.1 VACUUM AND FLOW ASSESSMENT

Two main types of assessments may be performed during pilot-scale testing or validation/startup activities: step tests and steady-state tests. DTSC recommends use of both a step and steady-state vacuum/flow assessment.

2.1.1 Step Test

Step testing is used to determine the optimum sustainable flow from the subsurface. During step testing, the flow is incrementally increased over time as the vacuum level in the SVE well and vapor monitoring wells is documented. The flow rate is increased by manipulating the blower system.

2.1.2 Steady-State Test

The steady-state or constant rate test is implemented at the optimum flow rate to acquire vacuum data from the subsurface and to determine potential maximum influent cVOC concentrations for the SVE system and the optimal SVE well spacing. This vacuum data is obtained from multiple monitoring locations. Typically, an optimum flow rate is derived from step testing and used as a parameter in steady-state testing. The stabilized vacuum readings obtained from monitoring well infrastructure during steady-state testing are used to define the full-scale zone of capture of the SVE treatment system.

2.2 ZONE OF CAPTURE ASSESSMENT

Zone of capture is the most important parameter to be considered in the design of a SVE system because it controls the mass removal rate and thus the efficiency and timeframe for site cleanup. Also referred to as the zone of remediation, the zone of capture is defined as the greatest distance from a SVE well at which a sufficient vapor flow can be induced to adequately enhance volatilization and extraction of the soil contaminants. The rate of mass removal via volatilization is a function of the volume of air passing by the contaminated soil per unit of initial contaminant mass.

Experience with SVE systems has shown that, for effective mass removal rates, zone of capture typically ranges between 40 and 100 feet. A smaller zone of capture is often needed to enhance mass removal rates in heterogeneous or fine-grained soil. A smaller zone of capture may also be needed to improve mass removal efficiencies and thus meet specific project deadlines (e.g., timeframe to begin redevelopment). The zone of capture appropriate for a SVE system should be evaluated on a site-specific basis, preferably using the method described in Section 2.2.1 or 2.2.2. On a case-by-case basis, DTSC may consider proposals to demonstrate an appropriate zone of capture during the system startup and validation process (see Section 2.2.4 for further discussion).

Regardless of the method used to estimate the zone of capture, performance data collected during pilot testing and/or system startup and validation and on-going operations should be used to confirm the adequacy of the initial zone of capture estimate. If the evaluation indicates that the zone of capture estimate was inaccurate, the system may require modification so that the RAOs can be achieved. See Section 2.2.4 for further discussion.

2.2.1 Pore Gas Velocity Approach

The approaches described in USACE (2002) and DiGiulio and Varadhan (2001a) can be used for the quantification of SVE system zone of capture. These approaches are based on the pore gas velocity and consist of two general steps. First, air permeability of the subsurface is determined. Then, the subsurface pore velocities associated with a SVE well, and the resulting zone of capture, are calculated using the air permeability. Typically, the zone of capture is defined by soil pore velocities of 0.01 cm/s (DiGiulio and Varadhan, 2000, 2001a) or greater. (Note: The zone of capture is inversely proportional to the pore gas velocity.) SVE wells should be placed so that their zones of capture completely cover the area of contamination with a slight overlap.

USACE (2002) and DiGiulio and Varadhan (2001a) should be consulted for detailed description and the technical basis for zone of capture derived from pore gas velocity estimates. A generalized description of the pore gas velocity approach is summarized below. Other appropriate methods may also be used.

Step 1. Vacuum response data are used to estimate the permeability ratio (ratio of horizontal to vertical permeability) and horizontal air permeability of the subsurface. These estimates can be determined using software designed for SVE system data analysis. Typical input parameters include:

- vacuum response data for monitoring points around each SVE well tested
- estimate of flow conditions (e.g., steady state, transient)
- estimate of subsurface conditions (e.g., leaky, semi-confined)
- blower flow rate
- estimated gas-filled porosity

Multiple scenarios (using realistic input parameters) should be used to find a reasonable approximation of the permeability ratio and horizontal air permeability.

Step 2. The air permeability ratio, horizontal air permeability, and other input parameters are used to estimate the pore gas velocity. This estimate can be modeled using software designed for SVE data analysis using an appropriate model domain, grid, boundary conditions, and input parameters. Typical input parameters include:

- permeability ratio / air permeability (e.g., as described in Step 1)
- blower flow rate
- anisotropy angle in the main principal flow direction[2]

[2] Obtained from literature values with consideration of site conditions

- soil porosity
- irreducible water saturation[2]
- van Genuchten soil-water retention parameters[2]

Multiple simulations, using realistic ranges of input parameters, are conducted to calibrate the model with a set of input parameters that provides the least average error between observed and simulated vacuum measurements at monitoring points. The calibrated model is then used to simulate the vacuum distribution and calculate pore gas velocity. To design the SVE system, this pore gas velocity can then be used to calculate a critical pore gas velocity[3] that results in an advection-dominated system.

Step 3. The pore gas velocity obtained in Step 2 is used to estimate the zone of capture for each SVE well. The USACE Manual recommends that critical pore gas velocities of 0.001 and 0.01 cm/s be used for design purposes.

2.2.2 Semi-Analytical Approach

An approach for the quantification of SVE system zone of capture is available that does not rely on the use of air permeability and pore gas velocities. The approach, which is described in Johnson and Ettinger (1994), utilizes SVE well extraction rates and subsurface contaminant mass estimations. Johnson and Ettinger (1994) should be consulted for detailed description, the technical basis, and potential limitations for the quantification of zone of capture by this method. When using this method, SVE wells should be placed so that zones of capture completely cover the area of contamination with a slight overlap.

The zone of capture is determined using Equation 6 of Johnson and Ettinger (1994). Selected parameters used by Equation 6 are described below.

Vapor Extraction Rate. The extraction rate for a single SVE well should be determined through pilot testing or estimated from professional experiences at nearby sites.

Contaminant Mass. The subsurface contaminant mass should be accurately quantified using both soil gas and soil matrix data. To obtain the most representative estimates of contaminant mass, soil matrix samples should be collected using USEPA Method 5035 (DTSC, 2004). Soil gas samples should be collected in accordance with *Advisory – Active Soil Gas Investigations* (DTSC/LARWQCB, 2003; revision pending).

Remediation Time Estimates. The timeframe for achievement of cleanup around the SVE well is needed to quantify zone of capture. By increasing the remediation timeframes, the zone of capture also increases proportionately.

[3] DiGiulio and Varadhan (2001b) defines a critical pore gas velocity as the pore gas velocity that results in slight deviation from equilibrium conditions (i.e., sufficient flow rate through soil to reduce cVOC concentrations in the soil gas phase and thereby create a driving force for further cVOC volatilization, desorption, and diffusion into soil gas for removal by advective transport).

Gamma parameter (γ). This parameter is a dimensionless measure of the progress of remediation. The value should be less than or equal to 1.0 for the quantification of zone of capture.

Alpha parameter (α). This parameter is the minimum volume of air per unit contaminant mass required to achieve cleanup under ideal conditions. The value should be at least 100 cubic meters of air per kilogram of contaminant mass for the quantification of zone of capture.

This semi-analytical approach is based upon the concept that the SVE effectiveness is a function of the volume of air that flows through the contaminated soil. Please note that zone of capture quantified with this method does not truly reflect the two-dimensional nature of the remediation process and should be used cautiously with contingencies to modify the SVE system as appropriate based upon post-implementation site-specific data.

2.2.3 Other Methods (Not Preferred)

Historically, the zone of capture has been referred to as the radius of influence (ROI) and has been derived using following methods that are no longer considered to be appropriate.

Pore Volumes. Assessment of minimum zone of capture is based on an estimate of the pore volume exchanges required to allow diffusion to reduce contamination to allowable levels. The total number of exchanges is divided by the maximum period of treatment to determine the exchange rate per year. The maximum flow rate of the SVE well is used in conjunction with the pore volume requirements to develop well spacing capable of achieving these treatment requirements. The method requires estimates of the contaminant mass in the vadose zone which can be difficult to quantify and typically provide a poor basis for a meaningful design zone of capture.

Graphical Regression. This method uses vacuum data collected from monitoring well infrastructure located around a central SVE well. Typically, this method uses a plot of steady-state vacuum levels versus distance from the central SVE well to the monitoring well data point. The zone of capture would be based on the volume of soil in which a selected minimum vacuum value (e.g., 0.2 inches of water) was present. However, vacuum response in the subsurface is independent of air permeability. Hence, the arbitrary selection of an observed vacuum as the definition of zone of capture is not a good indicator of the subsurface treatment zone.

As discussed further below, use of a zone of capture derived from these methods likely facilitates capture (containment) of contaminant vapors, but does not consider mass removal rates and other factors that can effect cleanup efficiency (e.g., contaminant/soil distribution, mass transfer considerations, chemical partitioning).

The graphical regressive method using subsurface pressure has been the method most often applied by practitioners. However, the zone of effective air exchange is often

much smaller than a ROI based upon pressure measurements (Johnson and Ettinger, 1994; Beckett and Huntley, 1994; Shan et al., 1992) and does not provide an estimate of the zone of effective air exchange in the subsurface. This issue is best discussed in Chapter 3 of USACE (2002):

> *"Historically, r_e [radius of pressure influence] has been used as the basis of design for extraction well networks. Designers have interpreted the zone of vacuum influence around a well as also corresponding to the "capture zone" of the extraction well. By subsequently selecting an arbitrary distance within this zone of vacuum influence, designers have established well spacings for SVE well networks. Unfortunately, this is a completely inappropriate interpretation of this phenomenon. . .SVE designs should be based on pore gas velocities or the rates of pore gas exchange, which, are a function of both the pressure (vacuum) distribution around the extraction point and the associated soil air permeability."*

2.2.4 Contingencies for SVE System Modification Based on Performance Data

The methods described in Sections 2.2.1, 2.2.2, and 2.2.3 can be used to develop the SVE well spacing. Regardless of the method used, the adequacy of the initial SVE well spacing should be verified based on performance data collected during the system startup and validation, and on-going operations. If the performance data indicate that the initial zone of capture estimate is inadequate, the system should be redesigned.

On a case-by-case basis, DTSC may consider proposals to demonstrate an appropriate zone of capture during the system startup and validation process, provided that:

- an adequate vapor monitoring well network is constructed as part of the initial system design;
- the design plan includes provisions for future SVE well installation based on operational data;
- the design plan includes a detailed strategy and procedures for system startup, testing, validation, and commissioning;
- a system validation and startup report is submitted; and
- DTSC is consulted and concurs with the decision.

In this instance, professional judgment would be used to develop a realistic initial estimate of the likely zone of capture. This initial estimate would be based on site characterization, experience at similar or nearby sites, and site-specific RAOs.

The system startup and validation report and subsequent status reports (see Section 6.0) should provide results, discussion of physical parameters (air permeability, measured zone of capture, air exchange rate, etc.), discussion of concentration trends in vapor monitoring wells and SVE wells, and discussion of other soil gas flow parameters. If the zone of capture used as the design basis is inadequate to achieve site-specific RAOs, the reports should document or provide recommendations for system modifications (such as the installation of additional SVE wells). Persistently

elevated concentrations even after system operation may be another indicator of the need for system modifications and re-design.

3.0 VAPOR WELL CONSTRUCTION AND PLACEMENT

3.1 SOIL VAPOR EXTRACTION WELLS

3.1.1 Construction

USEPA and USACE provide recommendations for SVE well construction. Typically, DTSC recommends a minimum of two-inch diameter SVE wells, but larger diameter wells should be considered if pressure loss is of concern.

3.1.2 Placement

To achieve maximum efficiency from a SVE well field, the SVE well screen intervals should be placed vertically to provide effective air flow through soils where cVOC concentrations exceed RAOs. The screen interval position should be determined through site characterization data (e.g., lithology, concentration etc,), modeling, startup testing, and/or pilot testing. Some wells should be targeted toward the interface between permeable and recalcitrant zones. At some sites, efficiency may be achieved by screening the SVE wells in the lower part of the target zone in order to reduce downward air flow from the ground surface, thus decreasing the air flow rate and resultant need to oversize blower and effluent treatment system. Well spacing should be selected to allow overlapping zone of capture between SVE wells. Overlapping zones of capture may produce “stagnant” zones that should be considered in the system design (GRA, 2007).

3.1.3 Additional Extraction Well Capacity

The number of SVE wells installed for a SVE system should be increased as necessary to meet the RAOs. The need for additional SVE wells should be evaluated based on pilot test data, initial performance data, system validation/startup performance data, and/or other monitoring data. Flexible system design (e.g., blower size, treatment capacity, vapor monitoring well location) will facilitate incorporation of additional SVE wells into the system.

3.2 SOIL VAPOR MONITORING WELLS

Monitoring well infrastructure is needed for design, operation, and closure activities. The monitoring wells are integral to the operation and closure activities associated with full-scale operation. Although multiple monitoring wells will be installed to support the pilot test or system validation/startup, additional monitoring wells may be needed based on the size of the full-scale SVE treatment system and if vapor monitoring wells are converted to SVE wells.

3.2.1 Construction

DTSC recommends construction of vapor monitoring wells with PVC materials and with a diameter of one to two inches (or larger to allow conversion to a SVE well). Typically, three to five foot interval screen intervals are preferred for vapor monitoring wells. Alternative construction methods consisting of dedicated, limited length screen intervals (i.e., six inches) attached to tubing are not recommended.

3.2.2 Well Placement

Multiple, multi-depth, discrete-interval monitoring wells should be located in different directions and varying distances from the SVE wells. At a minimum, vapor monitoring should occur at three locations from the SVE wells. Each monitoring location should screen multiple, discrete depths. The lateral and vertical placement of monitoring wells relative to the SVE wells should be based on the estimated zone of capture for the SVE well.

3.2.3 Screen Intervals

Monitoring wells should be screened in the most contaminated soils. Considerations for selecting potential zones for vapor monitoring well screen intervals include placement:

- in both permeable and recalcitrant zones
- at depths corresponding to desirable soil type
- with consideration of the SVE well screen intervals
- to allow evaluation of changes in the cVOC concentrations
- to allow evaluation of zone of capture
- to demonstrate achievement of the RAOs

4.0 OPERATIONAL ASSESSMENT FOR SVE SYSTEMS

Operational assessment of a SVE system is a combination of field instrumentation data (i.e., vacuum gage, photoionization detector, flow meter) and speciated cVOC analyses from the SVE treatment system (influent/effluent, SVE wells) and soil vapor monitoring wells. Initially, the SVE system is run at design specifications until monitoring data indicates a need for modifications to enhance cVOC recovery. Continued system operation will lead to a decrease in influent stream concentration that necessitates system optimization (Section 4.1) and eventually rebound assessment (Section 4.2). The USACE Manual (USACE, 2002) provides detailed discussion of these topics and additional resources are provided on the USEPA web-site (www.clu-in.org).

4.1 OPTMIZATION

Operation of the SVE system requires continuous optimization to ensure maximum contaminant recovery. The total mass (as evidenced by concentrations measured in SVE well effluent) typically decreases rather quickly within several weeks to a few months of operation and then reaches a condition where total concentration and mass removal rates have stabilized. In general, these conditions occur when the total cVOC concentration in combined extracted vapor does not vary by more than 1 to 5 percent during several consecutive monitoring events. The optimization effort should begin at the onset of the full-scale operation. However, when total cVOC concentrations stabilize, it becomes particularly important to optimize because it will shorten the operation time for the SVE system. This optimization effort should be documented in an appropriate report.

4.1.1 Potential Optimization Activities

Optimization activities generally consist of adjusting the SVE system air flow capacity such that the vapor extraction is occurring from the wells having the highest mass removal rates or closest to zones with cVOC concentrations exceeding RAOs. Potential optimization activities might include:

- rebalancing the air flow capacity to SVE wells with the highest mass removal rates and/or nearest to zones where RAOs have yet to be achieved; this rebalancing would include reducing air or eliminating flow at SVE wells producing low mass flow (e.g., wells completed in diffusion-limited areas) and increasing flow from SVE wells that are producing higher mass flow (indicative of an on-going source of vapors);
- reducing the overall system flow rate to address contaminant mass moving primarily by diffusive transport (by use of available frequency control, mechanical pulley changes, or change in blower capacity);
- further characterization of low permeability zones using advanced site characterization tools (such as membrane interface probes, SimulProbe®[4], or equivalent) to create a vertical profile of soil types, cVOC concentrations, and cVOC mass versus depth;
- vertically profiling existing SVE wells using PneuLog®[4] (or equivalent device) to obtain data on the vertical profile of advective and diffusive layers;
- placing additional short-screened SVE wells below or within diffusion-limited zones;
- alternating between SVE wells to reduce power and vapor treatment requirements (such as when diffusion limitations require extended remediation times and lower flow rates); and/or
- adjusting blower/total extraction rate to maximize the rate of contaminant removal.

[4] Use of trade names does not constitute endorsement by DTSC

Higher flow rates or vacuums will generally not improve cVOC removal from low permeability soils. Sites with relatively thin layers (i.e., less than 2 feet) of low permeability soils surrounded by high-permeability sands can be more effectively remediated by using smaller blowers and lowering the flow rates to better address contaminant vapors migrating primarily by diffusive transport. Accepting longer operating times at lower flow rates with less frequent monitoring and sampling is often the most cost-effective strategy for sites with low permeability soils.

4.1.2 Pulse-Mode Operation (Optional)

A SVE system can also be operated in "pulse" mode as a means of system optimization. For evaluation of optimization, the SVE system may be shutdown periodically to evaluate whether subsurface concentrations may "rebound" or "spike". This evaluation is sometimes performed when mass recovery rates decrease. Stabilized total cVOC concentrations in SVE system influent should not be used as the sole basis to support the need for pulse-mode operation. For instance, at highly contaminated sites, the level of influent concentrations may become stabilized, but are high enough to result in significant mass removal (which supports continued SVE system operation). In addition, a number of factors will require evaluation in order to determine if the observed stabilized concentrations are truly reflective of conditions necessitating further optimization through pulse-mode operation.

The pulse-mode operation may begin once the influent concentrations are stabilized and reflective of low mass removal rates. Pulse-mode operation can be implemented in the following steps:

- completing other SVE system optimization actions (see Section 4.1.1);
- operating the SVE system until low mass rates and stabilized influent concentrations are present under optimized operational conditions;
- performing all necessary field and speciated analysis of influent, SVE well, and monitoring well concentrations while system is operational;
- performing all necessary field and speciated analysis of SVE and monitoring well concentrations at end of inoperative period;
- turning the SVE system off for an appropriate period based on concentration trends and/or discussions with DTSC (experience has shown that this is usually a few weeks to a few months);
- turning the SVE system back on and optimizing the operation based on results of latest analyses; and
- repeating this series of activities until analyses indicate that the SVE system is ready for rebound or closure assessment.

If significant mass recovery occurs during the pulse-mode operation of the SVE system, the operator should evaluate whether increased SVE well density would resolve the need for pulse mode operation by providing greater pore velocity in the subject areas.

4.2 REBOUND ASSESSMENT

Rebound assessment requires that the SVE unit is temporarily shut down to evaluate whether subsurface RAOs have been achieved. The timeframe for rebound assessment is a site-specific determination and should have sufficient duration so that the measured soil gas concentrations represent equilibrium conditions at steady-state. A site-specific timeframe for rebound assessment can be determined using the approach described in Johnson et al. (1999).

Rebound assessment requires collection of soil gas samples at equilibrium from SVE wells and vapor monitoring wells. The soil gas samples should be collected pursuant to the *Advisory – Active Soil Gas Investigations* (DTSC/LARWQCB, 2003; revision pending). Monitoring wells are preferred for this assessment because of the shorter screen intervals. These data are compared to the RAOs. Hence, rebound assessment requires:

- baseline samples from site characterization data and/or vapor monitoring wells just prior to pilot-scale testing or system startup;
- samples collected immediately prior to or just after cessation of SVE operations; and
- samples obtained during multiple sampling events at appropriate time increments after cessation of SVE operations. The number of samples should allow visual estimation of concentration trends. The time period over which the samples are collected should consider the estimated time for steady-state concentrations to be reached at each monitoring location.

When soil rebound concentrations indicate a need for further vadose zone remediation, the SVE system is restarted. Typically, only SVE wells that can influence zones requiring additional mass removal should be reactivated (as indicated by data obtained during the rebound assessment). Extraction continues until the concentration of the extracted gas in the inlet stream re-stabilizes and mass removal rates are low. At this point, another shutdown period with soil gas monitoring begins. The cycle continues until steady-state soil gas concentrations in all vapor monitoring wells remain below clean-up goals or until it is apparent that no further progress is being made by the SVE system. An appropriate number of sampling events should transpire over a period of time to demonstrate that residual cVOC concentrations are stable and that the RAOs have been achieved.

5.0 SVE REMOVAL ACTION MONITORING

This section identifies general considerations for the development of a site-specific monitoring approach used to evaluate SVE system performance and remediation progress.

5.1 MONITORING LOCATIONS

During SVE system operation, remedy performance and cleanup progress is monitored by collecting soil gas samples from: treatment system influent, treatment system effluent, SVE wells (Section 3.1), and soil vapor monitoring wells (Section 3.2). Vacuum measurements at SVE and vapor monitoring wells may also be needed. Collectively, these data are used to make decisions about system operations, modifications, optimization, rebound, and shut down (see Section 4.0).

5.2 SAMPLING FREQUENCY

Typically, SVE wells and soil vapor monitoring wells are sampled frequently during SVE system startup to ensure mass removal is occurring as expected and to provide a basis for system adjustments or modifications. Hence, during the SVE system startup, sampling of SVE wells and soil vapor monitoring wells on weekly (or more frequent) basis may be needed. These data are used to assess and adjust system operation. The concentration data obtained during this period are useful comparators when the system enters rebound assessment. The data may also be useful for identifying unknown cVOC sources within the zone of capture of the SVE system.

The sampling frequency can be reduced as the system and concentration behavior becomes better understood. Temporal plots of concentration are useful for evaluating the transition from frequent startup sampling to the reduced frequencies for routine monitoring of the system. For many sites this transition occurs about a month or so after startup.

During routine monitoring, the sampling frequency for a given well should consider its function, location, and concentration behavior. The selected frequency should also consider the expected duration of the removal action (e.g., more frequent sampling for short duration removal actions). Operating SVE wells are often monitored frequently (e.g., monthly, quarterly) to allow timely adjustments to system performance. Soil vapor monitoring wells containing relatively high concentrations may also be sampled relatively frequently (e.g., quarterly) to allow assessment and tracking of concentration behavior. Soil vapor monitoring wells containing relatively low concentrations may warrant a lower sampling frequency with a provision for resampling if unexpectedly high concentrations are detected. The well can be identified for more frequent sampling if the high concentration is confirmed by the resample.

5.3 EVALUATING SVE WELL DATA

SVE well data is used to determine whether concentrations fall within expected ranges and whether adjustments to the SVE system are needed. For example, if concentrations do not decrease by at least one order of magnitude within an expected

timeframe (e.g., after 12 to 18 months of operation), the possible causes of the concentration behavior should be evaluated. Optimization measures such as increasing airflow from selected SVE wells or installing additional SVE wells may be appropriate. As another example, if a SVE well has a relatively low mass removal rate (such as might be caused by diffusion constraints), airflow from this well could be decreased, perhaps allowing increased airflow from another SVE well with a higher mass removal rate. A low mass removal rate may also indicate other potential problems (such as short-circuiting caused by poor annular seals).

5.4 EVALUATING SOIL VAPOR MONITORING WELL DATA

Soil vapor monitoring well data are evaluated to determine whether concentrations are behaving as expected and whether adjustments to the SVE system are needed. Persistently high cVOC concentrations after months of operation may warrant increased airflow from the nearest SVE well or adjustment of airflow in an interfering SVE well. Persistently high concentrations could also indicate the need for an additional SVE well (at an appropriate distance and depth interval). Another option is to use the vapor monitoring well as a SVE well (provided that the casing diameter is adequate and does not produce large fluid energy loss).

5.5 MONITORING DURING REBOUND EVALUATION

During a rebound assessment (Section 4.3), soil gas samples are collected and analyzed at appropriate time intervals. Data from soil vapor monitoring wells are preferred for rebound assessment because of the shorter screen intervals. Significant concentration rebound during the first few sampling events after system shutdown indicates a need to optimize and restart the SVE system. If no significant rebound occurs and the *in situ* concentrations have been monitored and evaluated over an appropriate period of time (pursuant to Johnson et al., 1999), the next step typically is an assessment of whether the system is ready for site closure (Section 7.0).

5.6 SAMPLING TO SUPPORT CLOSURE ASSESSMENT

The closure assessment for a SVE system (see Section 7.0) should be based on data obtained from the inlet stream and depth-specific soil gas data obtained throughout the baseline extent of the vapor plume. The depth-specific data can be collected from existing vapor monitoring wells and from soil gas borings completed in areas of the baseline plume extent that were not specifically monitored during the SVE removal action. The need to confirm the level of vadose zone treatment with soil matrix sample analysis is a site-specific determination that is dependent on the RAOs. Samples should be collected pursuant to Cal/EPA guidance (DTSC, 2004; DTSC/LARWQCB, 2003, revision pending).

6.0 STATUS REPORTS

Periodic status reports should be submitted to DTSC that summarize the performance of the SVE system. The status report contents should be based on pre-defined reporting needs and objectives. Typical topics addressed by status reports may include:

- total mass recovery (including basis for mass calculations)
- graph of cumulative mass removed
- influent/effluent concentration to treatment system
- individual well concentrations
- individual SVE well concentration trends
- trend analysis
- mass emission rate
- operating parameters
  - startup date
  - hours operated during reporting period
  - cumulative operating hours to-date
  - SVE wells in operation
  - operating vapor extraction rate
  - total air volume extracted during reporting period
  - carbon usage
  - caustic usage
  - utility water usage
  - power usage
  - wastewater discharged
  - operating temperature
- deviations to operating system
- causes of shutdown
- O&M activities
- equipment repair and replacement
- optimization efforts
- costs to operate, monitor, and maintain the SVE system
- significant events/activities during reporting period
- scheduled upcoming activities
- map of SVE system
- field documentation (maintenance logs, shutdown logs, checklists)

Additional topics may be appropriate based on site-specific considerations.

7.0 SYSTEM SHUTDOWN AND CONFIRMATION OF CLEANUP

In general, the site is ready for an analysis of SVE system shutdown after:

- the SVE system has been optimized to the extent feasible (Section 4.1);
- rebound assessment (see Section 4.2) indicates that RAOs have been achieved; and
- a sufficient period of time has passed since final system shutdown to allow residual cVOC concentrations to equilibrate to steady-state conditions.

A system may also be ready for shutdown when the performance assessment indicates that no further progress is being made and that additional remedial approaches would be needed to address the remaining contamination.

At sites where the SVE system has achieved RAOs, the closure analysis typically includes:

- preparation of plots of:
  - cVOC concentrations versus time (SVE and monitoring wells)
  - cumulative extracted mass versus time
  - mass removal versus time throughout the SVE operation (including any pulse-mode periods);
- depth-specific soil gas sampling (and soil confirmation sampling if applicable) to assess residual cVOC concentrations throughout the baseline plume extent (Section 5.6);
- documentation of the optimization and rebound assessment efforts (Section 4);
- confirmation sample data analysis and documentation;
- estimated total cVOC mass in the vadose zone after SVE treatment;
- assessment of the potential for residual cVOCs to pose an on-going threat to groundwater and/or human health;
- if residual cVOC concentrations pose a continued threat to groundwater, evaluation of whether the threat can be mitigated by an alternate vadose zone remedy and/or the groundwater remedy; and
- economic feasibility analysis for continued operation of the SVE system (if appropriate).

The USACE Manual (USACE, 2002) and DiGiulio and Varadhan (2001b) provide detailed discussion of SVE system shutdown and cleanup confirmation.

8.0 ANNOTATED OUTLINE FOR SVE SYSTEM PILOT TEST WORKPLAN

Preface: The following annotated outline identifies potential content for a SVE system pilot test workplan. This outline is not intended to be prescriptive and should be adjusted as appropriate for site-specific conditions. Some elements identified may apply to your site, while others may not. Additional elements than are addressed by the outline may also be needed. This outline is for guidance only, and is applicable on a case-by-case basis.

1.0 INTRODUCTION

Instructions: Provide a general description of the site and pilot test area. Present the purpose and scope of the pilot test, including the regulatory framework under which it is being conducted. Identify the performance measures and applicable data metrics to be collected. Identify the response agency. Outline the workplan organization.

- 1.1 Site History, Operations, and Features
- 1.2 Scope and Objectives of Pilot Test
- 1.3 Workplan Organization

2.0 SUMMARY OF EXISTING CONDITIONS

Instructions: This section should orient the reader to the site and provide sufficient background information so that the reader can evaluate the proposed design of the pilot test. Provide an overview of the site geology and hydrogeology. Identify the depth to water and typical water table fluctuation. Summarize available data on the nature and extent of contamination in soil, soil vapor, and groundwater. If applicable, describe results of previous pilot studies. Support this section with appropriate figures and tables.

- 2.1 Site Lithologic and Hydrogeologic Conditions
- 2.2 Soil Quality
- 2.3 Soil Vapor Quality
- 2.4 Groundwater Quality
- 2.5 Results of Previous Pilot Studies

3.0 SITE CONCEPTUAL MODEL FOR VOLATILE CONTAMINANTS

Instructions: Provide a narrative description and schematic diagram of the CSM for cVOCs. Clearly describe the source and current locations of contaminants. Provide figures showing the extent of the soil vapor plume in plan view and in cross-section. Describe the fate and transport of cVOCs in the vadose zone and groundwater. Discuss the potential exposure pathways for the cVOCs (e.g., inhalation from groundwater, vapor intrusion into indoor air, ingestion and dermal contact with contaminated groundwater). Describe any considerations associated with expected emissions from the SVE system.

3.1 Source and Current Location of Contaminants
3.2 Extent of Soil Vapor Contamination
3.3 Transport
3.4 Health Effects of Contaminants

4.0 SELECTION OF RESPONSE ACTION

Instructions: Indicate why the response action is being implemented (e.g., mitigate cVOC-impacted soil and soil vapor, protect of groundwater, protect human health, mass removal). Briefly describe why SVE is considered to be a proven technology and remedy or indicate that the PT&R approach to Remediation of Chlorinated VOCs in Vadose Zone Soils is being used. Provide the rationale for using SVE as the response action at the site.

4.1 Proven Technologies and Remedies
4.2 Soil Vapor Extraction and Treatment

5.0 DESIGN OF SVE PILOT TEST

Instructions: Identify the objectives of the pilot test (e.g., determine air permeability, zone of capture, flow rate/vacuum for blower sizing, condensate production, concentration trends, water table response). Provide a detailed description of the infrastructure that will be used to conduct the pilot test, including all wells, piping, blowers, and treatment components. Identify any noise or CEQA considerations for the pilot test. Indicate the instrumentation that will be used during the test (such as to measure vacuum/pressure, flow, temperature, and barometric pressure). Provide figures illustrating the SVE system layout, treatment system, and instrumentation.

5.1 Pilot Test Objectives
5.2 SVE and Soil Vapor Monitoring Well Design
5.2.1 Well Depths and Spacing
5.2.2 Design and Materials
5.3. Piping
5.4 Treatment System
5.5 Other Infrastructure
5.5.1 Blower
5.5.2 Valves
5.5.3 Monitoring Points
5.5.4 Sampling Ports
5.5.5 Instrumentation
5.5.6 Power Source
5.5.7 Condensate Collection, Storage, and Secondary Containment

6.0 SVE PILOT TEST SYSTEM INSTALLATION

Instructions: Identify the activities to be conducted prior to system installation (e.g., permitting, utilities clearance, stakeholder outreach). Identify health and safety issues associated with system installation. Describe the well installation methods, including drilling methods, any soil sampling and analysis that will be conducted as part of well installation, equipment decontamination, and handling of investigation-derived waste. Indicate the installation requirements for the piping system (e.g., soils management, damage protection, equipment decontamination). Describe the installation requirements for the treatment system and blower.

- 6.1 Pre-Installation Activities
  - 6.1.1 Permitting
  - 6.1.2 Utilities Clearance
  - 6.1.3 Community Relations
- 6.2 Health and Safety
- 6.3 Personnel and Responsibilities
- 6.4 Well Installation
  - 6.4.1 Drilling Methods
  - 6.4.2 Soil Sampling and Analysis
  - 6.4.3 Well Construction and Installation
- 6.5 Piping
- 6.6 Treatment System
- 6.7 Other Infrastructure
- 6.8 Decontamination
- 6.9 Waste Management

7.0 PILOT TEST SYSTEM OPERATION AND MAINTENANCE PROGRAM

Instructions: Outline the O&M program for the system. Provide the procedures for starting up and operating the system (e.g., duration, leak and blockage checks, test operational sequence, step testing, system operational parameter measurements, measurement locations). Identify the data analysis procedures (such as air permeability, zone of capture, system curve construction, mass removal rates, treatment efficiency). Describe the monitoring and sampling program to be implemented during the pilot test, including the measurement/analytical parameters, measurement/sampling frequencies, measurement/sampling locations, methods, and equipment. Identify the system shutdown strategy (e.g., how test completion will be determined, decommissioning, or incorporation into the final remedy). Indicate how the system performance will be evaluated and reported. Identify the type, content, and frequency of reporting. Identify contingencies in the event of system failure or unacceptable performance (i.e., specific actions to be taken, response times, contacts).

- 7.1 System Start-Up
- 7.2 Operating Strategy
  - 7.2.1 Procedures
  - 7.2.2 Data Analysis

7.2.3 Operation Schedule
7.2.4 Contingency Plan
7.3 Shutdown Strategy
7.4 Monitoring and Sampling Program
7.4.1 Operational Parameters
7.4.2 Chemical Parameters
7.5 Performance Evaluation and Reporting

8.0 PROJECT SCHEDULE

Instructions: Provide a schedule for implementing the pilot test.

9.0 REFERENCES

Instructions: Provide the references used to support the pilot test design and workplan.

TABLES
Geologic and Hydraulic Properties of Stratigraphic Layers
Geotechnical Parameter Test Methods

FIGURES
Site Location Map
Site Features Map
Cross Section of Site Stratigraphy
Conceptual Site Model of Vapor Distribution
Soil Vapor Plume Distribution (various depth intervals)
Groundwater Isoconcentration Contour Map
SVE Pilot Test Location Map
Proposed Pilot Test SVE and SVM Well Locations
Proposed Pilot Test SVE and SVM Screen Intervals
Schematic SVE and SVM Well Construction Diagrams
Schematic of SVE Treatment System Process Flow Diagram

APPENDICES
Field Data Sheets
Statement of Qualifications

9.0 ANNOTATED OUTLINE FOR SVE SYSTEM PILOT TEST REPORT

Preface: The following annotated outline identifies potential content for a SVE system pilot test report. This outline is not intended to be prescriptive and should be adjusted as appropriate for site-specific conditions. Some elements identified may apply to your site, while others may not. Additional elements than are addressed by the outline may also be needed. This outline is for guidance only, and is applicable on a case-by-case basis.

EXECUTIVE SUMMARY

1.0 INTRODUCTION

Instructions: Provide a general description of the site and pilot test area. Identify the purpose, scope, and objectives of the pilot test. Identify the performance measures and applicable data metrics. Indicate the regulatory framework under which the test was conducted. Identify the responsible agency. Outline the report organization. Reference the pilot test workplan.

- 1.1 Site History, Operations, and Features
- 1.2 Scope and Objectives of Pilot Test
- 1.3 Report Organization

2.0 PROJECT BACKGROUND INFORMATION

Instructions: Briefly orient the reader to the site and provide sufficient background information so that the reader can evaluate the pilot test results. Support this section with appropriate figures and tables.

- 2.1 Site Setting
- 2.2 Site Background

3.0 PILOT TEST DESCRIPTION, OBJECTIVES, AND PROCEDURES

Instructions: Provide an overall description of the pilot test, including the test objectives, equipment, and procedures. Also describe any departures or exceptions from the workplan.

- 3.1 Remedial Technology Description
- 3.2 Pilot Test Objectives
- 3.3 SVE Well Installation
- 3.4 Pilot Test Equipment
  - 3.4.1 Wells and Piping
  - 3.4.2 Vapor Collection System
  - 3.4.3 Vapor Pretreatment System
  - 3.4.4 Vapor Treatment System

3.4.5 Ancillary Systems
3.4.6 Monitoring Equipment and Instrumentation
3.5 Pilot Test Permitting
3.6 Pilot Test Procedures
3.6.1 Startup and Testing
3.6.2 Performance Tests
3.6.3 System Modifications During Startup

4.0 FIELD AND LABORATORY DATA

Instructions: Describe the monitoring and data collection activities conducted prior to and during the pilot test, including any departures/exceptions from the workplan. Describe the noise readings and locations, including comparison to local noise ordnance requirements. Examples of pre-test data include static water level data, soil and air temperature, static pressure, and atmospheric conditions.

4.1 Field Data
4.1.1 Pre-Test Data
4.1.2 Chemical Parameters
4.1.3 Temperature
4.1.4 Pressure/Vacuum
4.1.5 Flow Rate
4.1.6 Noise Readings and Locations
4.2 Laboratory Data
4.2.1 Geotechnical Data
4.2.2 Chemical Data
4.2.3 Data Quality

5.0 DATA ANALYSIS AND INTERPRETATION

Instructions: Provide an analysis of the test data with references to appropriate in-text tables, graphs, and figures. Include supporting documents as appendices.

5.1 Achievable Flow Rates
5.2 Zone of Capture
5.3 Field Permeability
5.4 Chlorinated VOC Removal Rate
5.5 Effectiveness of SVE
5.5.1 Treated Soil Vapor
5.5.2 Residual Soil
5.5.3 Recovered Condensate

6.0 CONCLUSIONS AND RECOMMENDATIONS

Instructions: Discuss the test findings and whether there is a need for additional work. If applicable, describe the design basis for the full-scale SVE system.

6.1 Overall Effectiveness of Technology
6.2 Needs for Further Study
6.3 Design Basis for Full-Scale System

7.0 REFERENCES

Instructions: Provide the references cited in the report and used as the basis for any calculations.

TABLES

Zone of Capture Data
Vacuum vs. Flow Data
Equipment List
Sampling and Analytical Method Summary
Removal Rate Summary
Zone of Capture Summary
Chemical Analytical Results Summary
Summary of Air Permeability Tests/Calculations
Well Construction Details
Full-Scale SVE Design Parameters

FIGURES

Site Location Map
Site Features Map
SVE Pilot Test Location Map
Cross Sections of Site Stratigraphy and Well Screen Intervals
Schematics of SVE System Layout
As-builts of SVE System
Construction Schematics
Representative Graphs of Air Flow vs. Applied Vacuum
Representative Zone of Capture for Selected Wells
Representative Graphs of Concentrations over Time
Representative Graphs of Response Vacuum vs. Distance
Map of Vacuum Response Isopleths

APPENDICES

Laboratory Analysis Reports
QA Reports
Field Data Sheets
Well Installation and Boring Logs
Air Permeability Evaluation
Zone of Capture Calculations and Evaluation
Flow Rate Calculations
Recovery Rate Calculations for Each Test Well
Graphs of Data for Each Test Well

10.0 ANNOTATED OUTLINE FOR SVE SYSTEM STARTUP AND VALIDATION REPORT

Preface: The following annotated outline identifies potential content for a SVE system startup and validation report, and can be used for sites that had a discrete pilot test phase as well as sites that choose to move directly into the startup/validation phase. As indicated in the outline, sites that moved directly into the startup/validation phase have additional content requirements (as discussed in Chapter 9 of the main text). This outline is not intended to be prescriptive and should be adjusted as appropriate for site-specific conditions. Some elements identified may apply to your site, while others may not. Additional elements than are addressed by the outline may also be needed. This outline is for guidance only, and is applicable on a case-by-case basis.

1.0 INTRODUCTION

Instructions: Provide a general description of the site and area addressed by the SVE system. Present the purpose and scope of the SVE removal action, including the regulatory framework under which it is being conducted. Identify the performance measures and applicable data metrics. Identify the response agency. Briefly orient the reader to the site and provide sufficient background information so that the reader can evaluate the results presented in the report. Outline the report organization.

- 1.1 Site History, Operations, and Features
- 1.2 Scope and Objectives of SVE Removal Action
- 1.3 Background
- 1.3 Report Organization

2.0 SVE SYSTEM COMPONENTS

Instructions: Identify and describe the various components of the SVE system. Include figures of the schematic layout of the treatment system as well as the overall system layout, including piping routes. If applicable, describe the construction and installation of the system components.

- 2.1 Vapor Extraction Wells
- 2.2 Vapor Monitoring Wells
- 2.3 Treatment Units
- 2.4 Vapor Extraction Blower
- 2.5 Conveyance Piping
- 2.6 Monitoring Stations
- 2.7 Utilities

3.0 SVE SYSTEM STARTUP SUMMARY

Instructions: Describe activities and findings during SVE system startup, including duration of startup activities, key dates, system settings and modifications, and the dates, types, and frequencies of monitoring. Describe the types and results of any tests (e.g., step, steady-state, isolation). Discuss the monitoring data obtained during system startup, including induced vacuum, field screening results, and laboratory sampling and analysis. As applicable, describe the system performance under various operational conditions (e.g., different SVE well configurations). If applicable, document the decision process that led to installation of additional SVE wells or a decision not to operate a given SVE well. As applicable, discuss data collected to address site-specific concerns (e.g., noise).

- 3.1 Baseline Soil Vapor Sampling
- 3.2 Initial Startup and Testing
- 3.3 Induced Vacuum
- 3.4 Field Screening
- 3.5 Laboratory Results
- 3.6 Instrumentation Settings
- 3.7 System Modifications During Startup

4.0 SVE SYSTEM OPERATIONS SUMMARY

Instructions: Describe the activities and results of the system operation following the initial startup period. Indicate the period of time reflected in the summary. Include an operation and maintenance summary (e.g., cumulative hours of operation, sorbent changeouts, sorbent consumption rate, system adjustments). Also discuss any administrative changes (e.g., changes to the permit requirements for the system emissions). Discuss inspections of the SVE system, monitoring events, and monitoring results. Identify any trouble-shooting activities, the measures taken, and the outcome.

- 4.1 Treatment Unit Issues
- 4.2 Operation and Maintenance Activities
- 4.3 Troubleshooting
- 4.4 Administrative Changes

5.0 DATA ANALYSIS

Instructions: Provide an interpretation of the data collected during the timeframe addressed by the report, including baseline data collected prior to system startup. Discuss the vacuum/pressure distribution induced by the SVE system. Estimate the pore gas velocity, zone of capture and mass removal rate induced by the SVE system.

- 5.1 5.1 Physical Parameters
  - 5.1.1 Vacuum/Pressure Distribution
  - 5.1.2 Flow Rate
  - 5.1.3 Pore Gas Velocity

5.1.4 Zone of Capture
5.2 Chemical Parameters
5.2.1 Treatment Unit Influent and Effluent
5.2.2 Vapor Wells
5.3 Mass Removal Calculations

6.0 CONCLUSIONS AND RECOMMENDATIONS

Instructions: Provide conclusions regarding the system effectiveness as well as recommendations for on-going operation and maintenance of the SVE system.

7.0 REFERENCES

TABLES

Well Completion Details
Equipment Summary
Operations and Maintenance Summary
Sampling Program
Summary of Samples / Data Collected
Well Data
Influent / Effluent Data
Field Monitoring Data
Field Operations Data
Vacuum Distribution
Flow Rate Calculations
Well Pressure / Flow Relationships
Calculation Summaries (air permeability, pore gas velocity, zone of capture)
Test Results Summaries (step, steady-state, isolation)
Mass Removal Summary

FIGURES

Site Location Map
Site Vicinity Map
Site Plan and Well Locations
Site Conceptual Model / Representative Cross Section
System Layout / As-built
Treatment System Schematic
Schematic System Flow Diagram
Isopressure Contours
Concentration Distribution (multiple depth intervals)
Time Concentration Graphs
Cumulative Mass Removal
Graphs of Test Data
Zone of Capture Extent

APPENDICES

- Permits
- Field Forms and Notes
- Laboratory Analytical Reports
- Residue Disposal Documentation
- Calculations
- Well Completion and Boring Logs
- Construction QA/QC
- Documentation of Residue Disposal

11.0 ANNOTATED OUTLINE FOR SVE SYSTEM DESIGN DOCUMENT

Preface: The following annotated outline identifies potential content for a SVE system design document. This outline is not intended to be prescriptive and should be adjusted as appropriate for site-specific conditions. Some elements identified may apply to your site, while others may not. Additional elements than are addressed by the outline may also be needed. This outline is for guidance only, and is applicable on a case-by-case basis.

1.0 INTRODUCTION

Instructions: Provide a general description of the site and pilot test area. Indicate the purpose of the document. Identify the scope and RAOs of the SVE system (e.g., protect receptors from exposure to cVOCs at the surface, protection of groundwater quality, reduce groundwater cleanup time and cost, and/or restore contaminated areas to support existing and proposed land uses). Identify the performance measures and applicable data metrics. Reference a table summarizing the quantitative cleanup goals. Identify the responsible agency. Outline the document organization.

- 1.1 Site History, Operations, and Features
- 1.2 Purpose of Document
- 1.3 Scope and RAOs of SVE System
- 1.4 Document Organization

2.0 BACKGROUND INFORMATION

Instructions: Orient the reader by providing sufficient background information about the site. Provide a brief overview of the site geology and hydrogeology and direct the reader to key project documents for further information. Provide a synopsis of the current knowledge of the nature and extent of contamination in soil, soil vapor, and groundwater, with a focus on the contaminants to be addressed by the SVE system or that may need to be considered during SVE system operation. Give a brief overview of the SVE technology being applied and indicate why SVE was selected as the remedial technology for the site. If applicable, describe results of previous pilot studies. Support this section with appropriate figures and tables.

- 2.1 Soil Contamination
- 2.2 Soil Gas Contamination
- 2.3 Groundwater Contamination
- 2.4 SVE as Remedial Technology for cVOCs in Vadose Zone

3.0 CONCEPTUAL SITE MODEL FOR VOLATILE CONTAMINANTS

Instructions: Provide the CSM for the SVE system. Identify the principle sources of cVOC contamination and the locations of these sources. If relevant, explain how these sources have changed over time (e.g., small core zone in shallow subsurface surrounded by a soil vapor halo, initial core area expanded by a smear zone caused by dropping groundwater levels). Describe horizontal and vertical extent of the soil vapor plume prior to start-up of the SVE system (e.g., baseline plume extent). Briefly describe the geologic materials to be remediated with emphasis on the characteristics that may affect SVE effectiveness (e.g., grain size, grain size distribution, stratification, moisture content, water table position, organic carbon content). Summarize the conceptual air flow model for the site (e.g., extent of SVE well influence, induced vacuum, air flow characteristics, potential for "short circuiting", slower cleanup of finer grained zones).

- 3.1 Sources of cVOCs
- 3.2 Soil Vapor Plume
- 3.3 Geology
- 3.4 Conceptual Air Flow Model

4.0 SVE IMPLEMENTATION PROCESS

Instructions: Present the overall process for implementing the SVE system. Identify the permit and other administrative requirements. Identify the steps that will be used to startup and test the SVE system (e.g., baseline sampling of vapor wells, the sequence of system startup, flow rate testing, leak checks, monitoring frequencies, types of measurements/samples, treatment unit performance assessment). Discuss the activities associated on-going operation of the SVE system (e.g., measurements/ sampling to assess performance and status, inspections to ensure proper operation of equipment) and reference the O&M plan. Indicate what performance measures might trigger optimization and what steps might be taken to optimize system performance (e.g., modify system flow rates, taking a well off-line, placing additional wells on-line, treatment system adjustments). Outline an initial strategy for curtailment and closure of the SVE system. To assist with the decision process for curtailing or closing the SVE system, provide a table summarizing possible response actions for specific influent concentrations, air flow rates, and/or mass removal rates (e.g., continue operating a given SVE well if the concentration is above a certain value; if the concentration in a given SVE well falls below a given value, turn off a SVE well and evaluate concentration rebound after an appropriate period of time).

- 4.1 Startup and Testing
- 4.2 Long-term Operation
  - 4.2.1 System Status and Performance Monitoring
  - 4.2.2 System Optimization
- 4.3 Curtailment and Closure Strategy

5.0 FIELD SAMPLING PLAN FOR OPERATING SVE SYSTEM

Instructions: Present the rationale, methods, locations, and frequencies for measurement and sampling activities related to SVE system evaluation, startup, operation, optimization, rebound assessment, and eventual closeout. Indicate that field and laboratory work will follow procedures and protocol provided in the QAPP. Address all types of samples and measurements associated with the SVE system (e.g., soil vapor, scrubber sludge, vacuum measurements). Provide tables and figures summarizing the sampling/measurement frequencies for various system components.

- 5.1 Sampling Locations
- 5.2 Sample Collection Procedures and Analytical Methods
- 5.3 Field Quality Control Samples
- 5.4 Sampling Frequencies

6.0 SVE GENERAL DESIGN AND ENGINEERING CONSIDERATIONS

Instructions: Identify the SVE system components and provide the details regarding the design and function of each component. Indicate the design process for the SVE system (e.g., phased approach, total system approach) as well as the planned design submittals and content (e.g., drawing package will include treatment pad layout and details, piping and mechanical details, process and instrumentation diagram, and electrical single line diagram). Describe measures to be used for noise control and other considerations identified in the CEQA process. Describe the procurement process for the system components. Briefly discuss system operations, referring the reader to Section 4.0 for details. Identify the design and engineering documentation that will be prepared (e.g., design package, O&M plan, report addressing observations and difficulties encountered during the start-up period).

- 6.1 Soil Vapor Wells
- 6.2 Soil Gas Collection System
- 6.3 Vacuum System
- 6.4 Emission Control System
- 6.5 Utility Requirements
- 6.6 SVE System Implementation
  - 6.6.1 Engineering Design
  - 6.6.2 Procurement
- 6.7 Design Submittals
- 6.8 Construction Activities
- 6.9 Operations
  - 6.9.1 Startup and Initial Operations
  - 6.9.2 Long-Term Operations
  - 6.9.3 System Optimization
- 6.10 Documentation

7.0 SVE SYSTEM OPERATIONS REPORTING

Instructions: Indicate the types and frequency of reports to be provided. Identify the purpose, objectives, and typical content of each report.

- 7.1 Status Reports
- 7.2 Periodic Monitoring/Operations Reports

8.0 RESIDUALS MANAGEMENT

Instructions: Identify the residuals that will generated by the SVE system and how the residuals will be managed. Describe any requirements (such as secondary containment) for residual storage areas.

- 8.1 Liquids/Water
- 8.2 Sediments/Solids

9.0 QUALITY ASSURANCE PROJECT PLAN

Instructions: Present the organization, functions, procedures, and specific QA and QC activities designed to achieve the DQOs for the SVE system.

- 9.1 Project Management
  - 9.1.1 Title and Approval Sheet
  - 9.1.2 Table of Contents
  - 9.1.3 Distribution List
  - 9.1.4 Project Organization
  - 9.1.5 Problem Definition/Background
  - 9.1.6 Project/Task Description and Schedule
  - 9.1.7 Data Quality Objectives and Criteria for Measurement Data
  - 9.1.8 Special Training Requirements/Certification
  - 9.1.9 Documentation and Records
- 9.2 Measurement/Data Acquisition
  - 9.2.1 Sampling Process Design
  - 9.2.2 Sampling Method Requirements
  - 9.2.3 Sample Handling and Custody Requirements
  - 9.2.4 Analytical Methods Requirements
  - 9.2.5 Quality Control Requirements
  - 9.2.6 Instrument Testing, Inspection, and Maintenance Requirements
  - 9.2.7 Instrument Calibration and Frequency
  - 9.2.8 Inspection/Acceptance Requirements for Supplies and Consumables
  - 9.2.9 Data Acquisition Requirements (Non-Direct Measurements)
  - 9.2.10 Data Management
- 9.3 Assessment/Oversight
  - 9.3.1 Assessments and Response Actions
  - 9.3.2 Reports to Management

9.4 Data Validation and Usability
9.4.1 Data Review, Validation, and Verification Requirements
9.4.2 Validation and Verification Methods
9.5 Technical Data Management

10.0 REFERENCES

Instructions: Provide the references cited in the document.

TABLES
Cleanup Goals
General SVE System Operation Parameters
Soil Parameters
Soil Gas Sampling Locations and Frequency
Emissions Sampling Frequency
Residuals Sampling Frequency
Measurement and Analytical Methods
QC Acceptance Criteria
QA Objectives for Emissions
Sample Container and Holding Time Requirements

FIGURES
Site Location Map
SVE System Location Map
SVE System Process Flow Diagram

APPENDICES
Field Data Sheets
Health and Safety Plan
Standard Operation Procedures
Vadose Zone Modeling
Calculations
Operations and Maintenance Plan
Pilot Test Report

12.0 REFERENCES

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DiGiulio, D.C. and R. Varadhan. 2000. Steady-State Field-Scale Gas Permeability Estimation, Pore-Gas Velocity Calculation, and Streamline Generation in a Domain Open to the Atmosphere. *Remediation: The Journal of Environmental Cleanup Costs, Technologies and Techniques*, v. 10, n. 4, p. 13 - 25.

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United States Army Corps of Engineers (USACE). 2002. *Engineering and Design: Soil Vapor Extraction and Bioventing*. Department of the Army, Document No. 1110-1-4001, June 2, 2002. 140.194.76.129/publications/eng-manuals/em1110-1-4001/toc.htm

United States Environmental Protection Agency (USEPA). 2006. *Off-Gas Treatment Technologies for Soil Vapor Extraction Systems: State of the Practice*. EPA 542-R-05-028. March. www.clu-in.org/download/remed/EPA542R05028.pdf

APPENDIX D

LINK TO ADDITIONAL RESOURCES

The following resources from the *PT&R Guidance – Remediation of Metals in Soil* are also applicable to cVOCs.

- Annotated Outline for Site Characterization Report
- Example for Bridging Memorandum
- Remedial Action Plan Sample
- Scope of Work for Corrective Measures Study
- Excavation, Disposal, and Restoration Plan Sample
- Annotated Outline for Excavation Completion Report
- Characterization Phase Workplan (Outline)
- Example for Statement of Basis
- Removal Action Workplan Sample
- Scope of Work for Interim Measures
- Transportation Plan (Outline)
- Public Participation Sample Documents

These appendices can be downloaded individually at the following location:
www.dtsc.ca.gov/SiteCleanup/PTandR.cfm

APPENDIX E
CONFIRMATION SAMPLING FOR SOIL EXCAVATIONS

Introduction

Confirmation sampling is conducted to determine whether the remedial action objectives (RAOs) for the soil excavation have been achieved. The remediation by excavation may address all or some of the following exposure pathways.

Soil Matrix RAOs. Soil matrix RAOs are developed for groundwater protection (soil leaching to groundwater pathway) and alleviation of direct contact exposure scenarios (dermal, ingestion, and particulate inhalation). Confirmatory soil matrix sampling involves the collection of samples from the floor and sidewalls of the excavation to demonstrate that contaminated soil was successfully removed.

Soil Gas RAOs. Soil gas RAOs typically are developed to alleviate vapor intrusion and outdoor air exposure. To verify that residual soil gas contamination is protective of human health, soil gas samples are collected around the perimeter of the excavation, and below the excavation footprint and/or within excavation backfill.

Confirmation sampling results can be used to support a post-remediation evaluation of risk (see Sections 6.5 and 8.8 of the main text).

Confirmation Sampling Plan

Confirmation sampling activities should be conducted in accordance with an approved confirmation sampling plan. The plan should consider the following:

- Soil gas and soil matrix samples should have the highest possible data quality objectives (DQOs).
- Statistical strategies that employ grids to facilitate the unbiased selection of sampling points should be used as appropriate. These strategies should provide a 95-percent confidence level of verifying the presence or absence of contamination.
- Flexibility to modify the sampling approach based on field observations and sampling results should be included. For example, non-statistical sampling may be used to evaluate areas where soil staining, odors, or hot spots are observed.
- Logistical considerations that may affect confirmation sampling approaches should be considered (e.g., sampling the sidewalls of a shored excavation).

The following resources may be useful in the development of the confirmation sampling plan:

- *Advisory – Active Soil Gas Investigations* (DTSC/LARWQCB, 2003)[1]

[1] Check the following link for the most current version of the document:
www.dtsc.ca.gov/SiteCleanup/Vapor_Intrusion.cfm#Vapor_Intrusion_Guidance_Documents

- *Interim Final Guidance for the Evaluation and Mitigation of Subsurface Vapor Intrusion to Indoor Air, Revised* (DTSC, 2005)[1]
- *Guidance Document for the Implementation of United States Environmental Protection Agency Method 5035: Methodologies for Collection, Preparation, Storage, and Preparation of Soils to be Analyzed for Volatile Organic Compounds* (DTSC, 2004)
- *Guidance on Choosing a Sampling Design for Environmental Data Collection for Use in Developing a Quality Assurance Project Plan, EPA QA/G-5S* (USEPA, 2002)
- *Guidance on Systematic Planning Using the Data Quality Objective Process, EPA QA/G-4* (USEPA, 2006a)
- *Data Quality Assessment: A Reviewer's Guide, EPA QA/G-9R* (USEPA, 2006b)
- *Data Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S* (USEPA, 2006c)
- *SW-846 On-Line* (USEPA, SW-846 On-Line)
- *Technical and Regulatory Guidance for the Triad Approach: A New Paradigm for Environmental Project Management* (ITRC, 2003)

Additional resources are available on the USEPA and Interstate Technology and Regulatory Council (ITRC) web-sites (www.clu-in.org; www.itrcweb.org), among other sources. Attachment A of this appendix provides an annotated outline for a confirmation sampling plan.

Soil Matrix Samples

Soil matrix samples are typically collected from the floor and sidewalls of the excavation using the sampling design identified in the confirmation sampling plan. These samples should be collected in accordance with USEPA Method 5035 (DTSC, 2004). Soil matrix sampling strategies based on incremental sampling methodology (ISM) are the subject of growing interest in the field of environmental restoration. However, ISM has yet to be fully accepted by the scientific community. The ITRC is currently developing ISM guidance and provides links related resources on its web-site[2]. If ISM is being considered for a given site, DTSC should be consulted to obtain concurrence with its use in confirmation sampling.

Post-excavation soil matrix sampling should occur as soon as possible after completion of excavation activities. Soil matrix samples should not be obtained from exposed excavation surfaces. Rather, soil matrix samples should be collected approximately six to eight inches interior to the exposed surface to alleviate potential sample bias due to the volatilization of contaminants.

[2] www.itrcweb.org/teampublic_ISM.asp

Soil Gas Samples

Soil gas samples should be collected from the around the perimeter of the excavation, and within and/or below the excavation footprint to evaluate the effectiveness of the remedy on eliminating the possibility of vapor intrusion. These samples should be collected at least five feet from exposed soil surfaces to minimize the effects of atmospheric influences on sample representativeness. Soil gas samples should be collected in accordance with DTSC/LARWQCB (2003) which recommends the installation of semi-permanent soil vapor probes.

Non-excavated subsurface cVOC sources can potentially contaminate clean backfilled material through vapor transport. Hence, where excavations are above contaminated groundwater or adjacent to cVOC hot spots, soil gas monitoring will be necessary to determine if the RAOs have been achieved. The duration of the post-excavation monitoring within the backfilled material and adjacent to the excavation pit should be based upon the time needed to re-establish subsurface equilibrium. The time to reach steady-state conditions can be determined using the methods described in Johnson et al. (1999). These timeframes can be lengthy for large excavations. If these monitoring timeframes are incompatible with schedules for property redevelopment, consideration should be given to expanding the size of the proposed excavation.

References

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USEPA. 2006c. *Data Quality Assessment: Statistical Methods for Practitioners, EPA QA/G-9S*. EPA/240/B-06/003. February. www.epa.gov/quality/qa_docs.html

USEPA. SW-846 On-Line: Test Methods for Evaluating Solid Waste, Physical/Chemical Methods. http://www.epa.gov/waste/hazard/testmethods/sw846/online/index.htm

ATTACHMENT A
ANNOTATED OUTLINE
CONFIRMATION SAMPLING PLAN FOR SOIL EXCAVATIONS

Preface: The following annotated outline identifies potential content for a confirmation sampling plan. The outline is not intended to be prescriptive and should be adjusted as appropriate for site-specific conditions. Some elements identified may apply to your site, while others do not. Additional elements than are addressed by the outline may also be needed. This outline is for guidance only, and is applicable on a case-by-case basis.

1.0 INTRODUCTION

Instructions: Describe the site location, description, and history. Identify the purpose, scope and objective of the confirmation sampling. Identify the responsible agency, project organization, and responsibilities. If the confirmation sampling plan is a stand-alone document, this section should be more comprehensive.

- 1.1 Site Location, Description, and History
- 1.2 Purpose, Scope, and Objectives of Confirmation Sampling
  - 1.2.1 Demonstrate Achievement of RAOs
  - 1.2.2 Waste Characterization
- 1.3 Responsible Agency
- 1.4 Project Organization and Responsibilities

2.0 SUMMARY OF EXISTING SITE DATA

Instructions: Briefly summarize the existing site data. Identify the estimated nature and extent of contamination. Include figures, such as plume maps and geological cross sections, that support the discussion.

3.0 SUMMARY SOIL REMOVAL ACTIONS

Instructions: Describe the soil removal actions to be taken prior to confirmation sampling. Identify the RAOs, cleanup goals, and regulatory criteria. Support the discussion with appropriate figures (e.g., a figure showing the estimated vertical and lateral extent of the excavation). Describe the approach to excavation activities and confirmation sampling (e.g., sequencing of excavation, logistical considerations, confirmation sampling, laboratory turnaround time, data evaluation and decision to backfill excavation).

- 3.1 Summary of Soil Removal Objectives
  - 3.1.1 Extent of Excavation
  - 3.1.2 Waste Characterization
  - 3.1.3 [Other appropriate subsections as applicable]
- 3.2 Cleanup Goals and Regulatory Criteria
- 3.3 Role and Timing of Confirmation Sampling in the Decision Process

4.0 CONFIRMATION SAMPLE COLLECTION

Instructions: Describe the sampling design that will be used to confirm that soil excavation efforts have achieved RAOs. Provide the objectives and rationale for sample locations and frequencies. Identify considerations for the timing of sample collection relative to excavation and/or backfill activities. If applicable, describe the method for establishing a sampling grid. Identify the sampling requirements and contingencies for unexpected conditions. Provide general sample collection and preservation procedures, and analytical methods. Reference the applicable field sampling plan.

- 4.1 Sampling Objectives
- 4.2 Sampling Design and Rationale
- 4.3 Sample Locations and Depths
  - 4.3.1 Rationale for Soil Sampling
  - 4.3.2 Rationale for Soil Gas Sampling
- 4.4 Sampling Requirements
- 4.5 Sampling and Analysis
  - 4.5.1 General Sample Collection Procedures
    - 4.5.1.1 Soil Matrix
    - 4.5.1.2 Soil Gas
  - 4.5.2 Laboratory Analytical Methods
  - 4.5.3 Quality Assurance/Quality Control
- 4.6 Contingencies for Unexpected Conditions

5.0 CONFIRMATION SAMPLE COLLECTION FOR WASTE CHARACTERIZATION

Instructions: Describe the sample collection methods for characterizing excavated soil prior to disposal or reuse and to identify the need for treatment prior to disposal. Indicate the sample collection frequency and rationale. Identify the sample requirements (e.g., discrete samples, composite samples). Provide general sample collection and preservation procedures, and analytical methods. Reference the applicable field sampling plan.

- 5.1 Sampling Objectives
- 5.2 Sampling Design and Rationale
- 5.3 Sample Locations
- 5.4 Sampling Requirements
- 5.5 Sampling and Analysis
  - 5.5.1 General Sample Collection Procedures
  - 5.5.2 Laboratory Analytical Methods
  - 5.5.3 Quality Assurance/Quality Control

6.0 DATA QUALITY OBJECTIVES

Instructions: Describe the DQOs, including analytical issues (e.g., method detection limits), QA/QC limitations on data, reproducibility, accuracy and precision, and other issues related to objectives of the confirmation sampling. Reference the applicable quality assurance project plan.

7.0 DATA EVALUATION

Instructions: Describe how the data will be evaluated (1) to support the decision to continue or stop the excavation and (2) to determine appropriate disposal or reuse of excavated soil and identify any treatment requirements. Include detailed descriptions of how the cleanup goals will be applied, the statistical evaluations that will be performed, and any other methods to be used. If appropriate, include decision matrices and/or flow charts to assist with the decision process.

7.1 Determination of Adequacy of Excavation
7.2 Determine Disposal, Reuse, and Treatment Requirements for Excavated Soil

8.0 REPORT

Instructions: Describe the format and schedule for reporting the confirmation sampling and data analysis results. Include all the elements of a standard investigation report, including conclusions and recommendations based on the data and data analysis.

9.0 HEALTH AND SAFETY PLAN

Instructions: A health and safety plan for confirmation sampling activities should be included as a separate section or appendix.

10.0 REFERENCES

Instructions: List all references cited in the plan.

APPENDICES
Field Sampling Plan (FSP)*
Quality Assurance Project Plan (QAPP)*

*The confirmation sampling plan should be supported by a field sampling plan (FSP), and a quality assurance project plan (QAPP). If to be developed in conjunction with the confirmation sampling plan, annotated outlines for a generic FSP and a generic QAPP are included in Appendix A2 of the *PT&R Guidance – Remediation of Metals in Soil*[3]. Alternatively, the confirmation sampling plan can reference an existing FSP or QAPP that adequately supports the confirmation sampling activities.

[3] www.dtsc.ca.gov/SiteCleanup/upload/Appdx_A2_083108.pdf

From:	Adam Michels
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	BOS file No. 210753 (Regarding 2550 Irving St loan)
Date:	Monday, July 19, 2021 9:14:44 AM
Attachments:	Screen Shot 2021-05-20 at 12.44.08 PM.png

This message is from outside the City email system. Do not open links or attachments from untrusted sources.



"This is a renderings created by an architect. It shows my house, my neighbors' houses, and the proposed building. It is not showing the actual design or color, but just the mass of the building."

Dear San Francisco Supervisors,

I urge you to vote no on the $14 Million Loan, principally because the correct process has not been followed. One of you (a supervisor) told me that when a project is in one Supervisor's District, that the other Supervisors will follow his or her lead in going forward or not.

In the Budget and Finance Committee hearing on Wednesday, July 14th, Supervisor Mar clearly told the other two supervisors that he found it problematic to recommend the loan before DTSC public comment on the remediation plan by TNDC. Amy Chan, the finance representative from TNDC, made the egregious statement that there would be no new information from the public comment. In other words, Amy Chan was saying to recommend the loan, because it does not matter what the public thinks about the plan to remediate cancer and Parkinson-causing PCEs in the soil. The other two supervisors, in their blind enthusiasm for affordable housing at any cost, disregarded Mar's plea for the normal process to be followed. One of them even quoted erroneous and outdated data on the PCE levels.

If you vote to approve the loan, you will be sending a message that the public comment period in the DTSC process has no impact on political decisions. Supervisor Mar himself knew there was something terribly wrong with this rush to circumvent the process, and strangely said something to the effect of, "Well I guess I'm outvoted. If you can't fight 'em, join 'em" [in ignoring the process and jamming through the loan recommendation].

I live in the second house on 26th Ave. from the proposed project. I have an old foundation under my home; it is full of cracks where PCE soil vapor can escape from the soil and go into my home. Yet, no one has even bothered to test for PCEs in my home. Six or more of my immediate neighbors suffer from cancer or Parkinson's disease.

I urge you to vote no on the loan to give a clear message to developers and your fellow legislators. Just because San Francisco needs affordable housing and SB35 gives you a streamlined process, does not mean you can forego the normal processes and guidelines that protect the health of San Francisco residents and the beauty and the functionality of the city itself. MOHCD needs to know that it needs a proper market study of a piece of land, that includes the cost of removal or remediation of any toxic chemicals, before committing taxpayer dollars to a piece of land that is offered at more than twice its assessed value.

Developers and Supervisors cannot be encouraged to cut corners and claim that nothing would be different if they did things the right way.

I urge you to say to TNDC and Supervisor Haney, “Go back and do this the right way. Saying that public comment on cancer-causing chemicals would not provide any new information is not a statement we endorse.”

Thank you.

Adam Michels
1275 26th Ave.

From:	Randall Mazzei
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject:	Opposed regarding Resolution #210763 - "7/20/21 BOS meeting"
Date:	Monday, July 19, 2021 8:30:23 AM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I **oppose** the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed. Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

● TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s. Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high. Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants. It should be right-sized to 4 stories.

● INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Resident, Randall Mazzei
2562 21st Avenue
San Francisco, CA 94116
randymazzei@hotmail.com
(415) 279-8702 C
(415) 681-8464 H

From:	Lew, Lisa (BOS)
To:	Board of Supervisors, (BOS); Wong, Linda (BOS)
Subject:	FW: My Family and I Oppose 2550 Irving Street Housing Project
Date:	Monday, July 19, 2021 8:25:53 AM
Attachments:	image001.png

For File No. 210763.

Lisa Lew
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T 415-554-7718 | F 415-554-5163
lisa.lew@sfgov.org | www.sfbos.org

(VIRTUAL APPOINTMENTS) To schedule a "virtual" meeting with me (on Microsoft Teams), please ask and I can answer your questions in real time.
Due to the current COVID-19 health emergency and the Shelter in Place Order, the Office of the Clerk of the Board is working remotely while providing complete access to the legislative process and our services.

Click here to complete a Board of Supervisors Customer Service Satisfaction form

The Legislative Research Center provides 24-hour access to Board of Supervisors legislation, and archived matters since August 1998.

Disclosures: *Personal information that is provided in communications to the Board of Supervisors is subject to disclosure under the California Public Records Act and the San Francisco Sunshine Ordinance. Personal information provided will not be redacted. Members of the public are not required to provide personal identifying information when they communicate with the Board of Supervisors and its committees. All written or oral communications that members of the public submit to the Clerk's Office regarding pending legislation or hearings will be made available to all members of the public for inspection and copying. The Clerk's Office does not redact any information from these submissions. This means that personal information—including names, phone numbers, addresses and similar information that a member of the public elects to submit to the Board and its committees—may appear on the Board of Supervisors' website or in other public documents that members of the public may inspect or copy.*

From: Sami Ngo <samipooo124@gmail.com>
Sent: Monday, July 19, 2021 8:25 AM
To: Lew, Lisa (BOS) <lisa.lew@sfgov.org>
Subject: My Family and I Oppose 2550 Irving Street Housing Project

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,
I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.
Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:
● TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high. Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
It should be right-sized to 4 stories.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.
- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.
- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.
- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.
- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.
I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

Samantha Tong
Sunset Resident

From: Sami Ngo
To: Wong, Linda (BOS)
Subject: My Family and I Oppose 2550 Irving Street Housing Project
Date: Monday, July 19, 2021 8:23:14 AM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,
I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.
Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:
● TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s. Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high. Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
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● CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.
● INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.
This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation,

environmental review and cleanup and additional community engagement.
I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

Samantha Tong
Sunset Resident

From:	Lew, Lisa (BOS)
To:	Board of Supervisors, (BOS); Wong, Linda (BOS)
Subject:	FW: OPPOSE Resolution number #210763, and "7/20/21 BOS meeting" - OPPOSE!!!
Date:	Monday, July 19, 2021 8:23:12 AM
Attachments:	image001.png

For File No. 210763.

Lisa Lew
San Francisco Board of Supervisors
1 Dr. Carlton B. Goodlett Place, Room 244
San Francisco, CA 94102
T 415-554-7718 | F 415-554-5163
lisa.lew@sfgov.org | www.sfbos.org

(VIRTUAL APPOINTMENTS) To schedule a "virtual" meeting with me (on Microsoft Teams), please ask and I can answer your questions in real time.
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From: Rosa Malone <ggchica1234@gmail.com>
Sent: Monday, July 19, 2021 6:42 AM
To: Lew, Lisa (BOS) <lisa.lew@sfgov.org>
Subject: OPPOSE Resolution number #210763, and "7/20/21 BOS meeting" - OPPOSE!!!

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Ms Lew,

Please, please, please consider a smaller building. The proposed size is huge and there will be a wall of shade for those who live behind it. And a wall in general. We don't need more eyesores in this city!

This is going in the wrong direction…….San Francisco was known for it's beautiful

size (and scale) and livability. People come and go, but this out-of-scale building will remain.

Thank you for your consideration.

Rosa Malone
1234 27th Avenue
SF 94122

From: Cathy Arima
To: Mar, Gordon (BOS); Board of Supervisors, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject: Resolution number #210763, and 7/20/21 BOS meeting / Oppose the pre-development loan for 2550 Irving Street (TNDC)
Date: Monday, July 19, 2021 7:37:01 AM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:-

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late ‘20s.

Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

Building 7 stories directly adjacent to the Sunset’s tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
It should be right-sized to 4 stories.

We need Design with Dignity — I can’t imagine the lack of quality of life for families living in a densified hotel development like this. There are many examples of affordable housing that offer much better choices for the families living in them. Please study them, so you can be accountable to the families who will eventually move in.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on

rehabbing other buildings and building ADUs to ultimately house even more families in D4.

- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

Cathy Arima

1274 - 28th Avenue

From:	Rosa Malone
To:	Wong, Linda (BOS)
Subject:	OPPOSE Resolution number #210763, and "7/20/21 BOS meeting" - OPPOSE!!!
Date:	Monday, July 19, 2021 6:39:02 AM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Ms. Wong,

Please, please, please consider a smaller building. The proposed size is huge and there will be a wall of shade for those who live behind it. And a wall in general. We don't need more eyesores in this city!

This is going in the wrong direction…….San Francisco was known for it's beautiful size (and scale) and livability. People come and go, but this out-of-scale building will remain.

Thank you for your consideration.

Rosa Malone
1234 27th Avenue
SF 94122

From: Gordon Chan
To: Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject: OPPOSE Pre Development Loan 2550 Irving Street Affordable Housing Loan & Project - Out of Scale & Bad For Neighbourhood
Date: Monday, July 19, 2021 6:23:49 AM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and property owner for over 20 years and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

  Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

  Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
  It should be right-sized to 4 stories.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Resident & Property Owner,

Gordon Chan & Johnson Chan
1322 27th Avenue SF CA 94122
1 (415) 519-9399

From: Gordon Chan
To: Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject: Resolution Number #210763, and "7/20/21 BOS Meeting OPPOSE Pre Development Loan 2550 Irving Street Affordable Housing Loan & Project - Out of Scale & Bad For Neighbourhood
Date: Monday, July 19, 2021 6:23:40 AM

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Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and property owner for over 20 years and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

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I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Resident & Property Owner,

Gordon Chan & Johnson Chan
1322 27th Avenue SF CA 94122
1 (415) 519-9399

From: Larry Strandberg-Lau
To: Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Subject: Resolution number #210763, 7/20/21 BOS meeting
Date: Monday, July 19, 2021 5:26:12 AM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I **oppose** the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

  Affordable housing is most successful when the scale and design blends in with the surrounding neighborhood. Other proposed affordable housing units in the Sunset are all 4-5 stories high.

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2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.

- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.

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This project should be right-sized to 4 stories instead of 7 with additional investment in infrastructure, additional parking, construction impact mitigation, environmental review and cleanup and additional community engagement.

I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Resident, Larry Lau

From: Pornvilai Buckter
To: Wong, Linda (BOS)
Subject: OPPOSE 2550 IRVING PROJECT!
Date: Monday, July 19, 2021 4:41:30 AM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late 20s.

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  Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
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- PARKING - Only 11% parking ratio is proposed. This means more parking difficulties for existing neighborhood residents and patrons of

local businesses. This warrants an increase in parking ratio for the proposed building to at least 25%.

- ENVIRONMENTAL CONCERNS - PCE vapors have been found underground at 2550 Irving St site as well as at the south side of Irving St. Before adding more new residents, the toxic plume on both sides of the block needs to be remediated. A full environmental review of the project should be conducted.
- CONSTRUCTION IMPACT - Single family homes that surround the site are standing on 100 year old foundations on top of the Sunset fine grain sand. A report and a plan is needed to define the monitoring and mitigation process for any construction impact.
- INFRASTRUCTURE - If the city wants to add 300+ people to this block, they need to study and plan to address any impact on traffic, transit, water/sewer and schools.

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I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

District 4 Resident,
Pornvilai Buckter
1369 29th Ave

Sent from my iPhone

From: Nick Stokes
To: Mar, Gordon (BOS); Board of Supervisors, (BOS)
Cc: Wong, Linda (BOS); Carroll, John (BOS)
Subject: Oppose the pre-development loan for 2550 Irving Street (TNDC)
Date: Sunday, July 18, 2021 11:50:23 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Supervisor Mar and the Board of Supervisors,

I am a Sunset resident and I oppose the approval of the pre-development loan for 2550 Irving Affordable Housing development and I oppose the project as currently proposed.

Our city and the Sunset desperately need more Affordable Housing, but as proposed, 2550 Irving Street is not the solution. Here are my concerns:-

- TOO OUT OF SCALE - The 7 story building as proposed by the TNDC is too out of scale with the surrounding neighborhood. It will be at least 3 times that of the biggest building in the area built in the late '20s.

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  Building 7 stories directly adjacent to the Sunset's tiniest homes not only robs neighbors of their privacy and solar rights, it reinforces the socio-economic isolation of tenants.
  It should be right-sized to 4 stories.

  We need Design with Dignity — I can't imagine the lack of quality of life for families living in a densified hotel development like this. There are many examples of affordable housing that offer much better choices for the families living in them. Please study them, so you can be accountable to the families who will eventually move in.

- TOO EXPENSIVE - This proposal comes with ~$1mil/unit price tag and is 60% over the average for new Affordable Housing in SF. Other proposals should be considered for this site including building a

smaller building at 2550 Irving and spending the rest of the budget on rehabbing other buildings and building ADUs to ultimately house even more families in D4.

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I urge you to listen to the D4 residents like myself and oppose this loan and this project as proposed in favor of a more appropriately sized and reasonably integrated 4 story development at 2550 Irving St for the benefit of new as well as existing residents and businesses.

Sincerely,

Nick Stokes
1261 28th Avenue

From: Christy Tam
To: BOS Legislation, (BOS); Lew, Lisa (BOS); Wong, Linda (BOS)
Subject: Letter for File# 210763, BOS meeting 7/20/21. from immediate neighbor of 2550 Irving project
Date: Sunday, July 18, 2021 10:27:52 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

July 18, 2021

Dear Supervisors:

My name is Zhao K Liang, I live within 1000 ft from the proposed project of 2550 Irving. I am writing on behalf of my family of 5 to oppose as proposed. We support 4 stories, but 7 stories is too high and does NOT fit the character of this neighborhood.

I am extremely upset for TNDC and Supervisor Mar for not been transparent about this project to the direct impact neighbors. Our voices were never been heard and never been respected. During Zoom meeting hosted by TNDC, every meeting was like a lecture, there was no two way communication between neighbors and developer TNDC or Mr. Mar. Tons of concerns bring up in meeting, none of them were answered. We were muted it after 2 meeting and chat box was closed due to high volume of concerns/questions. Again, TNDC did NOT want to hear from us, so they muted everyone.

I also attended the 6/30/21 community meeting at St Anne, over 170 people attend. Supervisor Mar was there only 40 minutes during the 2 hours meeting. Many neighbors got very upset and shout out to recall him because his did NOT do his job by bring our voices to the city hall.

This project is lack of transparency and lack of community engagement from the direct impact neighbors. Our family oppose as proposed!

Best

Zhao K Liang

From:	Jes
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Cc:	Jesmin Chui
Subject:	Regarding 2550 Irving St loan (BOS file No. 210753)
Date:	Sunday, July 18, 2021 10:00:03 PM

This message is from outside the City email system. Do not open links or attachments from untrusted sources.

Dear Board of Supervisors,

I'm writing to ask you to vote NO on the $14M predevelopment loan that allows TNDC to buy 2550 Irving Street for 100% affordable housing.

I support AH, but need it to be done right. While there are many reasons this project concerns me, the key reason to vote no now is it's premature to approve the loan when DTSC has only just begun the public comment period on the draft remediation plan, and we already have new information that tells us this draft plan is insufficient to keep current and new neighbors safe from PCE contamination.

Furthermore, the appraisal study also raised some red flags, suggesting that with PCE contamination, this site is only worth about 6.5 million dollars. Please do not waste taxpayers' money by paying $9M for a site that is worth about half of the price.

Jesmin

From:	Tiffany Xue
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Cc:	Tiffany Xue
Subject:	Regarding 2550 Irving St loan (BOS file No. 210753)
Date:	Sunday, July 18, 2021 9:49:21 PM

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Dear Board of Supervisors,

I'm writing to ask you to vote NO on the $14M predevelopment loan that allows TNDC to buy 2550 Irving Street for 100% affordable housing.

I support affordable housing, but need it to be done right. While there are many reasons this project concerns me, the key reason to vote no now is it's premature to approve the loan when DTSC has only just begun the public comment period on the draft remediation plan, and we already have new information that tells us this draft plan is insufficient to keep current and new neighbors safe from PCE contamination. Arthur Machado from DTSC also alluded that their action plan may not be sufficient due the condition of basement of nearby house. We have gathered photos of cracked foundation from nearby homes and some of them were emailed to Arthur Machado. Tom Soper, the architect from MSNA also took some fresh photos from several immediate neighbor's garage today.

We need to build AH with dignity. According to the industry benchmark, density with dignity is about 45-50 units/acre, but this proposed AH has more than 200 units/acre, 4 times denser that ideal ratio. It is not right to packed too many low-income tenants into a tower, as that will cause them feel stigmatized.

Much of the associated problems such as traffic, water, sewage, transportation related to this AH were ignored by TNDC as well.

Tiffany Xue
Resident near Irving and 27th Ave

From:	Richard Chui
To:	Mar, Gordon (BOS); Board of Supervisors, (BOS); BOS Legislation, (BOS); Wong, Linda (BOS); Carroll, John (BOS); Lew, Lisa (BOS)
Cc:	Richard Chui
Subject:	Regarding 2550 Irving St loan (BOS file No. 210753)
Date:	Sunday, July 18, 2021 9:37:58 PM

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Dear Board of Supervisors,

I'm writing to ask you to vote NO on the $14M predevelopment loan that allows TNDC to buy 2550 Irving Street for 100% affordable housing.

I support AH, but need it to be done right. While there are many reasons this project concerns me, the key reason to vote no now is it's premature to approve the loan when DTSC has only just begun the public comment period on the draft remediation plan, and we already have new information that tells us this draft plan is insufficient to keep current and new neighbors safe from PCE contamination. Arthur Machado from DTSC also alluded that their action plan may not be sufficient due the condition of basement of nearby house. We have gathered photos of cracked foundation from nearby homes and some of them were emailed to Arthur Machado. Tom Soper, the architect from MSNA also took some fresh photos from several immediate neighbor's garage today.

Furthermore, as the TNDC's shadow presentation reveals, almost all year long, my house will be under the shadow from this proposed 7 story building. We have a unique situation, i.e., my mom-in-law living with us right next to this proposed AH and she is 76 years old with cold autoimmune hemolytic anemia. Basically, her blood gets hemolyzed without sun therapy and lead to a life-threatening situation. TNDC's suggested solution is to have her use the yard in AH, but that is not feasible since she is homebound, with mobility issue. That said, this tall monstrosity will be detrimental to her health condition.

On 7/15/2021, Rumesha and I were interviewed by Lyanne Melendez from ABC7 News. I conveyed similar messages above and expressed my frustration that such concerns had been brought to TNDC, planning department, and the mayor, but gained no traction.

It is my hope that the politicians truly serve the people they represent, not to throw the entire community (immediate neighbors near the proposed AH) under the bus for political gain.

Respectfully,

Richard Chui
Richard.Chui@outlook.com
Sent from Outlook