STATE OF CALIFORNIA
CALIFORNIA REGIONAL WATER QUALITY CONTROL BOARD
SAN FRANCISCO BAY REGION

STAFF SUMMARY REPORT – Cheryl Prowell
MEETING DATE: May 9, 2018

ITEM: **7**

SUBJECT: **Vapor Intrusion Assessment and Mitigation** – Status Report

DISCUSSION: This status report describes new activities Water Board staff are implementing to address vapor intrusion (VI) and their implications for the Board's site cleanup programs.

VI is a concern at cleanup sites where volatile organic compounds (VOCs) have been discharged; most of our cleanup sites involve VOCs. VI causes a significant risk to human health at many of these cleanup sites, sometimes overshadowing the site's risk to the beneficial uses of groundwater. VI is a process where VOC contamination in soil or groundwater volatilizes into the gas phase and migrates up through soil and into overlying buildings. There are many factors that can affect how quickly volatile contaminants get into and out of a building. For example, the hydrogeology, soil properties, weather conditions, building design, building ventilation, contaminant type(s), contaminant location, and overall mass of contamination can all affect VI. Given the complexity of the VI process, the science behind VI is not fully understood but has been evolving over the years. As our understanding of VI changes, we need to update our approach to assessing and mitigating VI risk at our cleanup sites.

<u>Updating Vapor Intrusion Assessment Approach</u>
Historically, the Board and other regulatory agencies such as the Department of Toxic Substances Control (DTSC) have relied on VI models (primarily the Johnson and Ettinger Model provided by U.S. EPA) to set VI risk-based screening levels and to calculate the potential VI risk from subsurface contamination. However, two factors have caused us to question the applicability of these currently available VI models:

- An increasing number of studies are showing that sewer lines can contribute to VI, but current VI models do not consider this pathway; and
- U.S. EPA published an empirical VI database study. Current VI models used with scientifically defensible input parameters could not predict the results of that study.

Recently, many academic studies have also demonstrated that typical sampling plans, historically used to assess VI, lack sufficient sampling to

address the spatial and temporal variability of contamination. These studies also lack sufficient sampling to address confounding factors, such as indoor and outdoor sources of contamination and preferential pathways. Examples of preferential pathways include gravel backfill in sewer lines and utility trenches and penetrations of slab foundations to accommodate utility lines.

To address these concerns, our staff is working with representatives from DTSC and the State Water Board to update existing State guidance for VI assessment. Existing guidance includes DTSC's 2011 Vapor Intrusion Guidance and this Board's 2014 Interim Framework and 2016 Environmental Screening Levels. In the short term, this update will comprise new supplemental guidance to be used with existing guidance. The supplemental guidance will reflect recent advances in our understanding of VI so that investigations are consistent statewide.

The supplemental guidance will include VI screening criteria and recommendations for sampling to assess VI risk at both existing and potential future buildings. It will enable staff to determine when further action is required to reduce VI risk. The supplemental guidance provides a four-step investigation process: prioritize buildings, collect soil gas data, collect indoor air data, and evaluate VI risk. Appendix A provides more details.

The supplemental guidance is undergoing internal review at DTSC and the Water Boards and will be circulated to the public soon, most likely this summer.

Updating Vapor Intrusion Mitigation Approach

There are a range of actions that may be taken to control VI risk at a site. Active cleanup that removes or destroys the contaminants is preferred. Cleanup may not be possible at all sites or may take time to reduce contaminant concentrations to safe levels. If the public may be exposed to the contamination then mitigation measures are used to prevent unsafe exposure. VI mitigation measures may be short term, such as increasing ventilation, installing air purifiers, or relocating building occupants. Longer term mitigation measures are typically engineered systems to prevent vapors from entering or accumulating in a building (VI mitigation systems). These include vapor barriers and sub-slab venting or depressurization systems. In addition, long-term stewardship measures such as deed restrictions can require site management plans and prohibit sensitive land uses, like residential housing or day care centers.

In 2014, U.S. EPA Region 9 issued guidance setting short-term response levels for trichloroethene (TCE) in indoor air, one of the most common contaminants needing cleanup we encounter. U.S. EPA recommends using the short-term response levels to drive taking action within days or weeks to prevent reproductive toxicity. The new short-term response levels have caused us to re-evaluate our approach to VI mitigation. As such, we are taking a

closer look at what VI mitigation systems and measures we approve and what submittals we require during their planning, implementation, post construction monitoring, and long-term verification. We have several initial conclusions (see Appendix B). The theme is that VI mitigation is not a panacea. It's better to remove the VI risk by active cleanup when possible. If VI mitigation is necessary, then it needs to be properly designed, operated, and monitored, perhaps over many years, to provide reliable human health protection.

We plan to update our 2014 Interim Framework to incorporate these initial conclusions. The update should be completed by early 2019. We are taking into account input that we have received since 2014 and do not intend to have a formal comment period before revising this framework. We will provide an update to the Board when the new version is available.

Site Cleanup Implications

We are already experiencing several effects on our cleanup programs as a result of these changes in VI assessment and mitigation:

- More cleanup sites need VI assessments, due to the more stringent VI screening levels for soil gas and groundwater. Additionally, more sites need indoor air sampling.
- We are significantly expanding our public outreach efforts at sites that are doing VI assessments, particularly when indoor air sampling is needed.
- At some sites, we are requiring more active cleanup to meet more stringent VI screening levels, to avoid reliance on mitigation systems, and to minimize the duration of any VI mitigation.
- Where it's infeasible to meet VI screening levels with cleanup actions, we may need to oversee cleanup cases longer to assure that necessary VI mitigation is carried out for as long as the VI threat remains. As such, fewer cases may qualify for low-threat closure following active cleanup.

We expect to apply additional resources to fully respond to these changes in VI assessment and mitigation, both to ensure protection of human health and to avoid adverse effects on other important cleanup program priorities such as groundwater protection and restoration.

RECOMMEN-
DATION: This is an information item only and no action is necessary.

File No. 1210.47 (CLP)
Appendices:

A – Supplemental Guidance for Vapor Intrusion Assessment (Overview)
B – Updated Approach to Vapor Intrusion Mitigation

# APPENDIX A

SUPPLEMENTAL GUIDANCE

FOR

VAPOR INTRUSION ASSESSMENT (OVERVIEW)

Supplemental Guidance for Vapor Intrusion Assessment (Overview)

The following topics are discussed in the supplemental guidance:

- Recommendation for vapor intrusion screening criteria
- Building prioritization criteria for evaluating VI risk
- Soil gas, subslab, indoor air, and outdoor air sampling recommendations
- Criteria for determining when further cleanup action is required
- Information about when sewer lines may contribute to vapor intrusion
- Assessing current VI risk
- Assessing future VI risk at both existing and potential future buildings
- Using the information that we gather to refine our approach

The supplemental guidance provides a four-step investigation process, as follows:

Step 1 – Prioritizing Buildings. For situations where multiple buildings need investigation, start with the occupied buildings most likely to experience VI and work outward. The process should be expedited for sites with short-term hazards such as TCE, which can cause reproductive toxicity.

Step 2 – Collection of Soil Gas Data. Try to collect a soil gas sample near each building within 100 feet of contamination in soil or groundwater. At each location, samples should be taken from at least two depths. Soil gas plumes should be delineated in all directions. Seasons can affect VI, so sample at least twice. Use the data to estimate if building occupants are likely to be impacted.

Step 3 – Collection of Indoor Air Data. To determine where vapors are collecting inside a building, a number of samples are needed. Sample in at least three rooms. Sample below the building's foundation at the same time as its indoor air is sampled. Repeat the sampling up to three times to understand temporal variability. Check whether operation of the building's heating/ventilating/air conditioning system changes the results. Use the data to calculate the exposure risk.

Step 4 – Risk Evaluation and Management Decisions. Current VI risk is primarily determined using indoor air data. However, physical or operational changes to a building over time could allow VI risk to increase in the future. Therefore, future VI risk is primarily determined using soil gas data. If chemicals in indoor air and soil gas are below screening values, the building is considered low priority until the site is closed or new information is gained. If contaminants are detected above the recommended screening levels, action should be taken.

# APPENDIX B

UPDATED APPROACH

TO

VAPOR INTRUSION MITIGATION

Updated Approach to Vapor Intrusion Mitigation

We are taking a closer look at what VI mitigation systems we approve, and what submittals we require during the planning, implementation, post construction monitoring, and long-term verification of these systems. Specific changes to our typical requirements will include:

- *Stronger preference for active cleanup, instead of long-term mitigation:* Mitigation systems are considered a short-term solution to provide protectiveness while active cleanup is ongoing. Typically, we should approve mitigation systems after, or in conjunction with active cleanup, and rarely as a stand-alone option.
- *More aggressive mitigation designs:* In the past, VI mitigation systems relied predominantly on vapor barriers to block contamination migration into buildings. Research has shown that liners alone have little long-term effect. Instead, liners should be coupled with a sub-slab venting or depressurization system to remove vapors that accumulate below a building. Depressurization systems that rely on powered fans to create a vacuum below a building's foundation are generally the most effective systems.
- *Initial verification:* We want to see verification of liner installations as well as vapor testing below the slab and in indoor air before we conclude that the systems are working as designed. Municipal building departments often rely on our conclusions when granting occupancy for new buildings.
- *Ongoing monitoring:* As long as mitigation systems are needed to protect human health, they should be monitored. Depressurization systems can be monitored with pressure sensors that can send real time notifications if the system fails. The vapor below liners should be sampled periodically for both venting and depressurization systems.
- *Contingency planning:* If monitoring shows that a VI mitigation system is not effective, a plan should be in place to correct the problem in a timely manner. For depressurization systems, this typically involves replacing broken fans. For venting systems, this can involve adding powered fans or increasing flow rates.
- *Financial assurance:* VI mitigation systems may be needed for years to decades. A mechanism to fund ongoing system monitoring and maintenance should be established before a system is installed, especially at redevelopment projects.
- *Longer Board staff oversight:* Monitoring and case oversight should continue as long as soil gas measurements show that there is a VI risk. We used to consider low threat closure of a site as soon as the mitigation systems were installed, but we now recognize site closure should be driven by actual risk reduction at the site.