

# Memo



5205 Corporate Ctr. Ct. SE, Ste. A  
Olympia, WA 98503-5901  
Phone: 360.570.1700  
Fax: 360.570.1777  
www.uspioneer.com

**To:** Ed Jones, Washington Department of Ecology  
**From:** Bill Beck, Stericycle  
**Cc:** Chris Waldron, PIONEER  
**Date:** February 27, 2015  
**Subject:** Five-Year Review Assessment of the Vapor Intrusion Mitigation System  
Stericycle Georgetown Facility

---

PIONEER Technologies Corporation (PIONEER) has prepared this memo on behalf of PSC Environmental Services, LLC, which is a wholly-owned subsidiary of Stericycle Environmental Solutions, Inc. (Stericycle), for its Georgetown facility located in Seattle, Washington. In order to meet corrective action provisions of the facility's Resource Conservation Recovery Act (RCRA) Part B Permit (WAD 00081 2090) and the requirements of the Washington State Model Toxics Control Act (MTCA), potential vapor intrusion (VI) in the Georgetown neighborhood has been evaluated using a tier approach that was implemented in 2002 and revised in 2011 (PSC 2002; PIONEER 2011). The tiered approach was presented in the Vapor Intrusion Assessment and Mitigation (VIAM) Plan, which is Appendix G of the Engineering Design Report for the site (PIONEER 2011).

The purpose of this memo is to evaluate the effectiveness of the VIAM program as part of the Washington State Department of Ecology's (Ecology's) five-year review planned for May 2015.

## Summary of the VIAM Program

The VIAM Plan specifies a five-tiered approach for evaluated potential VI at the site:

- Tiers 1 and 2 – Groundwater monitoring data are compared to groundwater vapor intrusion remediation levels (VIRLs) to calculate a cancer cumulative exceedance factor (CCEF) and a noncancer cumulative exceedance factor (NCCEF). If either the CCEF or the NCCEF exceeds a factor of 10, the building is further evaluated under Tier 3 or proceeds directly to Tier 4. This evaluation is conducted every time a new residential (Tier 1) or commercial (Tier 2) building is identified in the project area.<sup>1</sup>
- Tier 3 – Building-specific sampling (potentially including indoor air, ambient air, groundwater, and soil gas/sub-slab soil gas sampling) is conducted to empirically determine whether or not installation of a VI mitigation system (Tier 4) is warranted.
- Tier 4 – A VI mitigation system is installed and operated to mitigate the VI pathway.
- Tier 5 – Groundwater monitoring data from the four most recent rounds of groundwater sampling are compared to VIRLs on a well-by-well basis. Buildings located proximate to wells where the CCEFs are less than or equal to 1 and NCCEFs are less than or equal to 10 for four consecutive sampling events will be identified as candidates for their VI mitigation systems to be shut down.

---

<sup>1</sup> A survey is conducted annually to identify new buildings or changes in land use in the project area.

## Effectiveness of the VIAM Program

Fifteen buildings (nine residential and five commercial) have sub-slab or sub-membrane depressurization systems that were installed, and are currently maintained, by Stericycle (see Figure 1). The depressurization systems are inspected and negative pressure testing is conducted annually to ensure that the systems are operating as designed. All inspection and monitoring results indicate that the installed systems are operating as designed and are protective of human health and the environment. Additionally, indoor air and groundwater samples are collected annually and triennially, and CCEFs and NCCEFs have been below the risk benchmark of 10 for the past five years (i.e., since 2010) at all but two wells.

Biannual groundwater monitoring is also conducted in Georgetown. Groundwater concentrations are compared to VIAM action levels (VIAMALS) to identify areas/buildings where VI may be of concern. Groundwater is evaluated for all constituents (cumulative), and individually for specific constituents (i.e., 1,1-dichloroethene, cis-1,2-dichloroethylene, trichloroethene, and vinyl chloride). The results of the groundwater monitoring evaluations indicate that constituent concentrations are generally decreasing. Figure 2 and Figure 3 present the most recent groundwater monitoring results and historic groundwater monitoring results.

Indoor air monitoring is conducted using summa canisters, which use negative pressure to collect a sample over a designated period of time (eight hours). Indoor air sampling for the site is conducted during the winter months (when the heat is running and all windows and doors are likely closed) in order to obtain a "worst-case" scenario concentration. Results of the indoor air sampling indicate that VI is not of concern at any of the monitored buildings and the VI mitigation systems continue to function as designed.

During the 2014 annual inspections of the depressurization systems, changes were noted in two of the residential properties. At one house, the attic was converted into an additional bedroom. The fan for the depressurization system was located in the attic, so an enclosure was constructed in order to prevent any vapors from leaking out of the fan housing and into the bedroom. At another residence, a dormer window was constructed near the fan exhaust. The fan exhaust piping was relocated to ensure that vapors would not enter the house through the window.

A new residential and a new commercial property were recently identified and Tier 1 and Tier 2 evaluation were conducted, respectively. Both properties had CCEFs/NCCEFs less than 10 and did not require further evaluation. No properties have had to be evaluated under Tier 3, Tier 4, or Tier 5 for the past five years.

## Best Practices/State of the Science

The VIRLs that are used to evaluate indoor air and groundwater concentrations are updated on an annual basis. If the state or federal toxicity values for any constituent of potential concern change, the VIRLs are recalculated.

Sub-slab or sub-membrane depressurization systems are still considered one of the best (and most common) methods for actively mitigating indoor vapor intrusion. Negative pressure readings have indicated that the installed systems continue to operate as designed and negative pressure is being maintained in all of the Tier 4 properties. The blower fans will be replaced in the future when they reach they end of their designated lifespan.

While other methods exist for collecting indoor and ambient air samples, summa canisters continue to provide the most accurate data for the eight hour sampling time period. Stericycle will continue to research and stay informed about

other technological advancements that may be made in the vapor intrusion mitigation field, and will implement any new technologies that would improve the performance of the depressurization systems.

## Conclusion

Based on the results of biannual multimedia sampling and annual groundwater monitoring, VI mitigation systems are continuing to function as designed and groundwater concentrations appear to be decreasing over time. The CCEFs and NCCEFs have consistently been below the benchmark of 10. The VIAM program continues to identify potential issues and is using products/processes that remain the state of the science.

## References

Philip Services Corporation (PSC). 2002. Revised Inhalation Pathway Interim Measures Work Plan. August.

PIONEER Technologies Corporation. 2011. Vapor Intrusion Assessment and Mitigation Plan. June.

## Enclosures

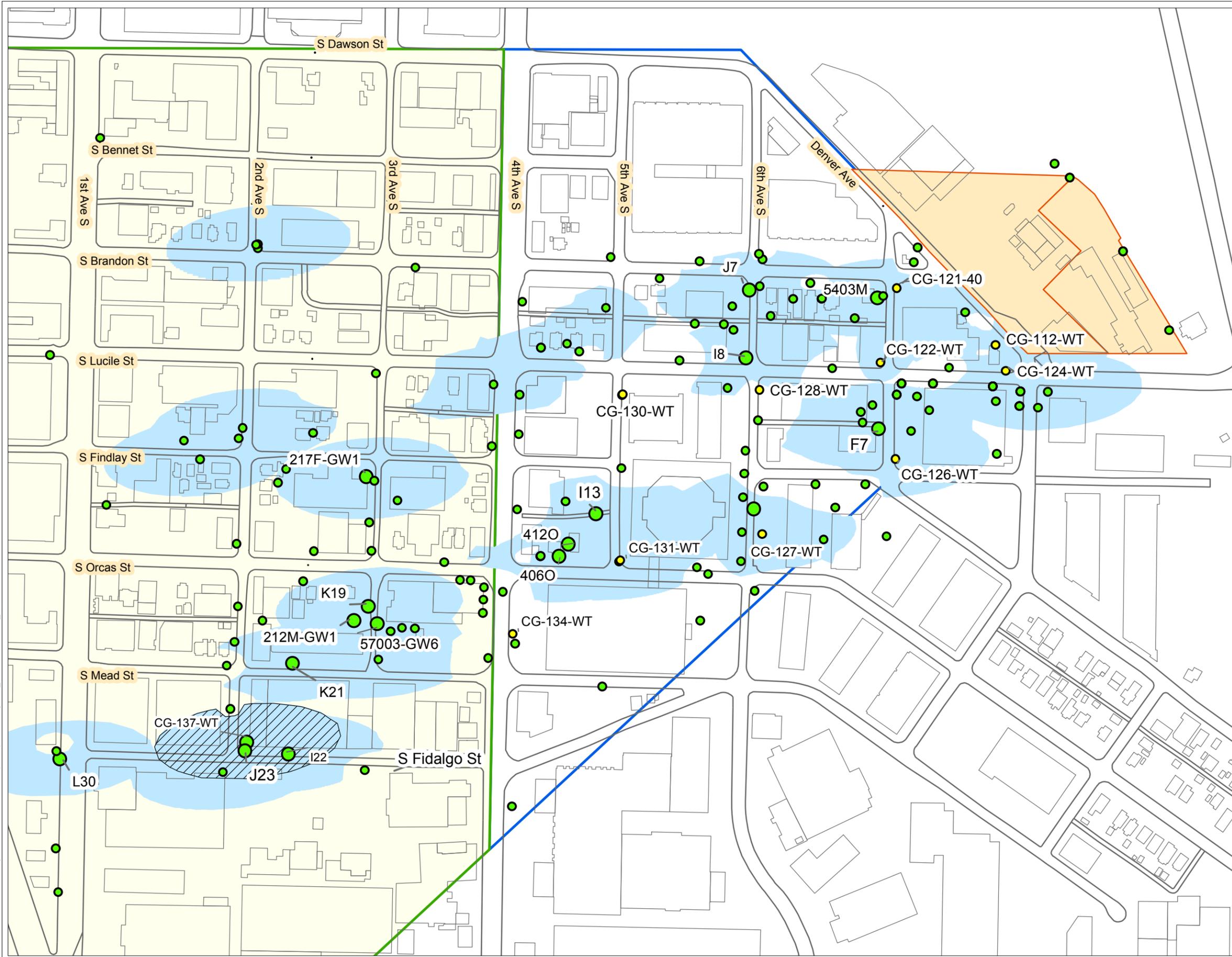
- |          |  |
|----------|--|
| Figure 1 | Tier 4 Property Locations  |
| Figure 2 | Comparison of Residential CCEFs for 3Q14 Groundwater Monitoring Well Results and Historic Monitoring Results |
| Figure 3 | Comparison of Commercial CCEFs for 3Q14 Groundwater Monitoring Well Results and Historic Monitoring Results  |



Tier 4 Property Locations  
Five-Year Review Assessment of the  
Vapor Intrusion Mitigation System  
Stericycle Georgetown Facility

Figure 1

Document Path: G:\Projects\PSC\GIS\Source\Maps\2015\Figure 2\_Residential CCEF\_3Q14.mxd; Author: BR; Date Saved: 2/27/2015



## Legend

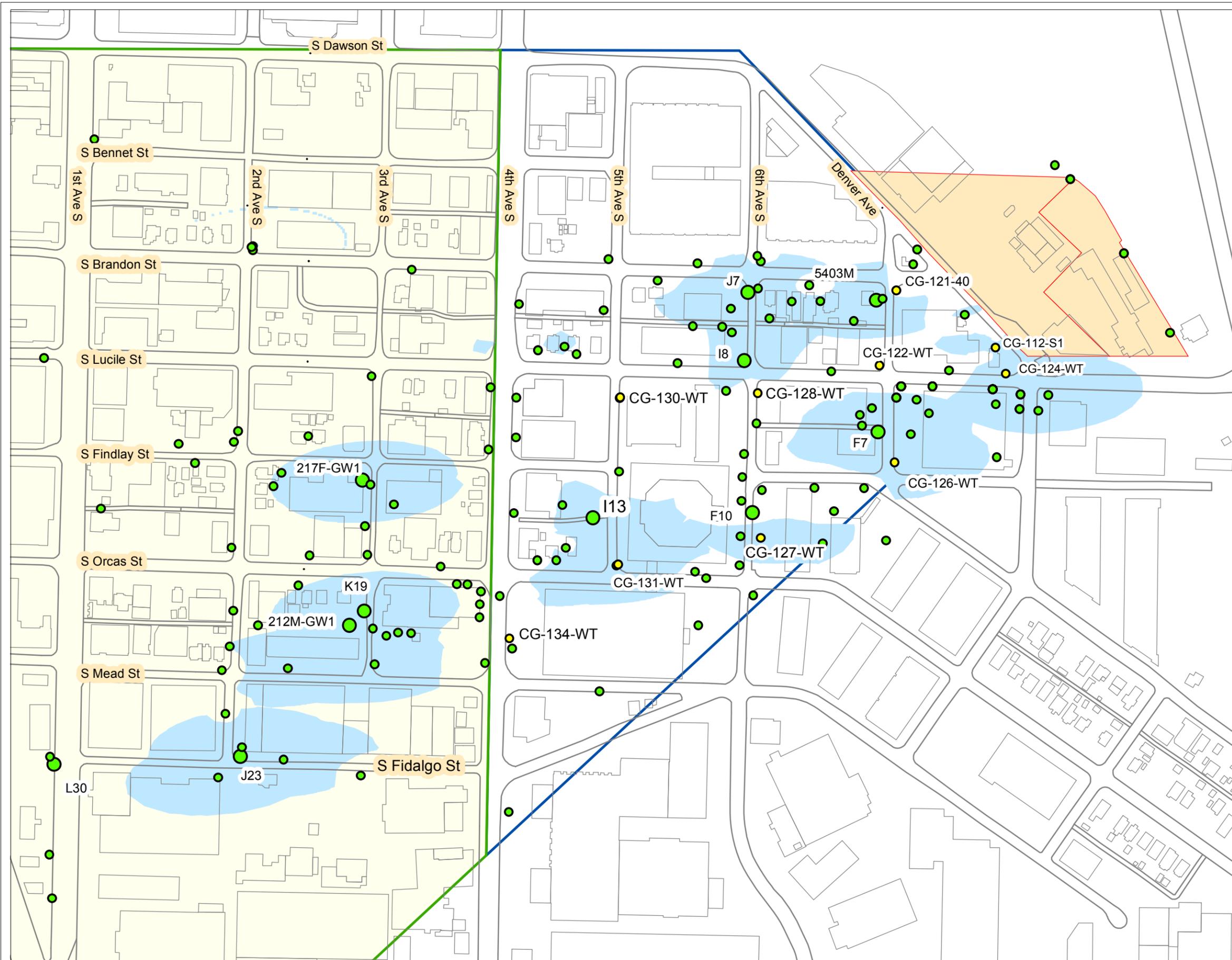
- Well Results**
- 1Q14 Well Results with CCEFs > 10
  - Historical Well Results with CCEFs > 10
  - 3Q14 Well Results with CCEFs < 10
  - Historical Well Results with CCEFs < 10
  - 3Q14 VIAM Residential CCEFs > 10
  - Previous Monitoring Results > 10 CCEFs\*\*
  - Areas 1 and 2
  - Area 3
  - Co-Mingled Plume Area\*\*\*
  - Buildings\_032906
  - Roads



## Notes

- Noncancer exceedances are co-located with the cancer exceedances.
- VIAMs for groundwater are based on a carcinogenic risk of 1E-6 and Hazard Quotient of 0.1.
- Groundwater VIAMs were updated in October 2012 due to updated toxicity values, and resulted in visible differences between 1Q12 and 3Q12 figures.
- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001.
- CCEF = Cancer Cumulative Exceedance Factor
- IDW = Inverse Distance Weighting Interpolation
- \* Based on 1Q14 monitoring well data and direct push well data (if the well was sampled). Otherwise, based on the most recent results for the monitoring well.
- \*\* Based on 2Q02, 3Q02, 4Q02, All Quarters 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 1Q11, 2Q11, 3Q11, 1Q12, 3Q12, 1Q13, 3Q13 & 1Q14 Monitoring Wells, and all Direct Push Results.
- \*\*\* The groundwater results west of 4th Avenue South are uncertain because they do not include the groundwater data that has been collected by potentially-liable parties to investigate non-PSC source areas that are located west of 4th Avenue South.

### Comparison of Residential CCEFs for 3Q14 Groundwater Monitoring Well Results and Historic Monitoring Results



## Legend

### Well Results

- 3Q14 Well Results with CCEFs > 10
- Historical Well Results with CCEFs > 10
- 3Q14 Well Results with CCEFs < 10
- Historical Well Results with CCEFs < 10

  3Q14 IPIM Commercial CCEFs > 10\*

  Previous Monitoring Well Results\*\*

  Areas 1 and 2

  Area 3

  Comingled Plume Area\*\*\*

  Buildings

  Roads



0 75 150 300 450 600 Feet

## Notes

- Noncancer exceedances are co-located with the cancer exceedances.
- VIAMALs for groundwater are based on a carcinogenic risk of 1E-6 and hazard quotient of 0.1.
- Groundwater VIAMALs were updated in October 2012 due to revised toxicity values, and resulted in visible differences between 1Q12 and 3Q12 figures.
- Areas 1, 2, and 3 were designated in the Draft Risk Assessment PSC 2001.
- CCEF = Cancer Cumulative Exceedance Factor
- IDW = Inverse Distance Weighting Interpolation
- \* Based on 1Q14 monitoring well data and direct push well data (if the well was sampled). Otherwise, based on the most recent results for the monitoring well.
- \*\* Based on 2Q02, 3Q02, 4Q02, All Quarters 2003, 2004, 2005, 2006, 2007, 2008, 2009, 2010, 1Q11, 2Q11, 3Q11, 1Q12, 3Q12, 1Q13, 3Q13 & 1Q14 Monitoring Wells, and all Direct Push Results.
- \*\*\* The groundwater results west of 4th Avenue South are uncertain because they do not include the groundwater data that has been collected by potentially-liable parties to investigate non-PSC source areas that are located west of 4th Avenue South.
- Six new direct-push groundwater samples were collected in the vicinity of 665 South Lucile Street from 1/11/2010 to 1/19/2010 at depths ranging from 12 to 60 feet below ground surface. The shallowest groundwater sample result from each direct-push location (which are most indicative of potential risks associated with vapor intrusion) had a CCEF of less than 10.

### Comparison of Commercial CCEFs for 3Q14 Groundwater Monitoring Well Results and Historic Monitoring Results