# A Dirty Secret: Duplicate Variability in Summa Canister Samples for Vapor Intrusion Investigations

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**Background/Objectives.** Field duplicate samples are commonly collected during environmental investigations to evaluate precision in the dataset. We have observed that, while normal and duplicate groundwater sample pairs typically exhibit high precision, the same is not true for vapor samples. The objective of this study is to understand the degree of duplicate variability in groundwater vs. vapor samples, and causes of the variability. It is important to note that one key difference in the sample collection process is related to sample containers. For vapor intrusion (VI) investigations, most samples are collected using Summa canisters. Unlike the disposable containers used for most types of environmental samples, Summa canisters are reused many times. As a result, proper cleaning of these canisters is critical for attainment of accurate investigation results, particularly for samples used to define clean locations and boundaries. Improperly cleaned canisters can result in detection of VOCs that are not actually associated with site contamination.

**Approach/Activities.** We have utilized field duplicates in the California GeoTracker database to evaluate whether the reuse of Summa canisters is a common source of errors in VI investigations. We extracted normal and duplicate vapor sample pairs from 400 sites covering a timeframe from 2003 to 2016. For each sample, we retained the analytical results for target analytes that were detected in one or both of the paired samples. For reference, we compiled a similar dataset for groundwater field duplicates. This resulted in more than 7,000 and 5,900 vapor and groundwater analyte-sample pairs, respectively.

**Results/Lessons Learned.** Our analysis indicates that vapor field duplicate samples exhibit much higher variability than groundwater field duplicate samples. For example, the difference between duplicate vapor results was greater than a factor of four in 19% of paired samples. In contrast, in the groundwater dataset, only 3% of results were more than a factor of four different. For both vapor and groundwater samples, the largest differences were observed in sample pairs with one detection and one non-detect result. For groundwater samples, these artifacts were mostly limited to common laboratory contaminants such as acetone. However, for vapor samples, these artifacts were also commonly observed for VOCs specific to contaminated sites such as cis-1,2-dichloroethene. Our analysis suggests that improperly cleaned Summa canisters are likely a significant source of false-positive VOC detections during VI investigations.