



INDOOR AIR INVESTIGATIONS AT NASA AMES RESEARCH CENTER AND NASA RESEARCH PARK



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Contact Information

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Future Indoor Air Sampling Methods at NASA

During the February 2007 sampling event, replicate duplicate QA air samples will be collected using SKC Ultra II passive diffusion samplers containing Tenax TA adsorbent. After completion of sampling, the chemicals absorbed on the sampling media are thermally desorbed by the analytical laboratory and analyzed by EPA method TO-17. Analysis by Method TO-17 is identical to EPA Method TO-15 once the sample is introduced into the gas chromatograph.

There are numerous advantages to the passive sampling technique and EPA Method TO-17:

- Cost - about one-half to two-thirds the cost of TO-15 and Summa® Canisters
- Logistics - the badges are about the size of a match box, consequently there are no storage issues and shipping costs are significantly reduced
- Intrusiveness - due to their small size, the passive diffusion badges are potentially much less intrusive on building occupants than Summa® Canisters

Results of Sampling at ARC Building N210

Building N210 on the NASA Ames Research Center campus was originally constructed as an aircraft hangar in the late 1930's. The building is located over the leading edge of a shallow regional VOC groundwater plume. Groundwater data (2003) indicates trichloroethene concentrations beneath the building of approximately 100 ug/L.

In June 2004 24-hr Summa® canister samples (N=14) were collected from two locations within the building. One location had a mean concentration of trichloroethene of 44 ug/m³ (range 14-110 ug/m³) and cis-1,2-dichloroethene concentration of 3.7 ug/m³ (range 1.3 to 8.2 ug/m³). The trichloroethene concentrations at the second location were low (< 1.7 ug/m³ maximum). Additional Summa® canister samples were collected from five indoor locations during September 2004 (N=19) to further delineate indoor concentrations. This sampling confirmed the results from the two original locations and also showed elevated trichloroethene concentrations at some of the new locations, but samples from other locations were not elevated.

In May 2005 the USEPA Trace Atmos-

pheric Gas Analyzer (TAGA) was used to conduct a building survey to better define locations with elevated trichloroethene concentrations. The results of this survey were used to select additional sample locations. Samples were collected from eight indoor locations (N=24) during July 2005 and from seven indoor locations (N=13) during September 2005.

These results indicated that the configuration of the HVAC system was the likely cause of the elevated trichloroethene concentrations at some of the locations sampled. Modifications to the buildings HVAC system were made in December 2005.

Confirmation samples were collected from eleven indoor locations (N=21) during January 2006 and from twenty-one indoor locations (N=83) during February 2006. These confirmation sample results indicated that the HVAC system modifications had achieved a significant reduction in indoor air breathing zone concentrations (trichloroethene < 1.0 ug/m³).

The total number of samples collected is summarized in Table 1

Table 1. N210 Summa® Canister Samples

Breathing zone total	Jun-04	Sept-04	Jul-05	Sep-05	Jan-06	Feb-06
Pathway total	7	9	12	6	8	11
Outdoor total	9	9	8	4	4	26
Grand Total	24	30	38	19	29	122

A Brief Summary of Indoor Air Sampling at Ames

Previous short-term indoor air studies had detected numerous VOCs in a number of buildings onsite. The indoor air samples for these buildings were all single 8-hour or 24-hour integrated samples. Groundwater monitoring has been conducted on the NASA Ames Campus and the NRP for approximately 15 years. In general, some of the chemicals detected in the indoor air and flux samples were also detected in the groundwater.

However, there are numerous chemicals (such as vinyl chloride) that have been detected in the groundwater, but have not been found, or have only been found sporadically, above detection limits in either the flux or indoor air samples.

From the end of June 2003 through June 2004 over 1200 Summa® canister air samples were collected from buildings B15, B16, B17, B20, N210, and N243 on the ARC campus and NRP. In addition, during September and October 2004 samples were collected from Buildings B15 and N210. All previous work plans and study results are available. As part of these prior studies both 24- and 8-hr samples were collected from indoor building locations, as well as outdoor ambient and background sampling locations. The study results indicated that indoor concentrations of cis-1,2-DCE and TCE in building N210 were elevated relative to the outdoor

ambient and background air samples. Results from the Building B15 September and October 2004 sampling, as well as the preliminary confirmation sampling from Building N210, also showed that modification to the HVAC system operating parameters could be effective in reducing these indoor concentrations.

As part of the Long Term IAQ study, two one-week sampling events were conducted in building N210 during June 2004. Additional follow-up samples were collected from N210 in September and October of 2004. Results for two locations showed significantly elevated cis-1,2-DCE and TCE concentrations, but samples collected from the other locations in N210 were similar to results in samples from some of the other buildings (B15, B16, B17, and B20) collected during the same time periods. The source of the high concentrations at these two locations were thought to be either a result of poor air flow or of collecting samples adjacent to preferential

vapor intrusion pathways. During the week of May 16, 2005 the USEPA conducted a walk-through survey of Building N210 using its Trace Atmospheric Gas Analyzer (TAGA) mobile laboratory. These results confirmed the previous SUMMA canister samples (Nepreme, 2005c). During two samples in July 2005, 65 24-hr buildings N210, N211, N239A, and N259, as well as outdoor ambient and background sample locations. These results clearly showed elevated TCE concentrations in N210 in some of the breathing zone sample locations, as well as in some of the pathway sample locations.

To confirm these results an additional 19 samples were collected from indoor breathing zone, pathway, outdoor and background locations in September 2005. Based upon these results, the elevated TCE concentration in room 143 was confirmed to be the result of the configuration of the HVAC fresh air supply. The ventilation

system in the adjacent space, Room 145, was similar to that in Room 143. The September sampling was designed to evaluate concentrations in the breathing zone and sub-floor within Room 145. These samples showed that the concentration of TCE in Room 145 was lower than that in Room 143. In December 2005 the HVAC system was modified to re-route the supply air duct and to provide separate ventilation for the sub-floor space.

After modifications were made to the N210 HVAC system in December 2005, twenty-nine breathing zone, pathway, outdoor ambient, and background samples were collected in January 2006 and 106 breathing zone, pathway, outdoor ambient, and background samples were collected in February 2006. These samples indicated that the HVAC modifications had significantly reduced the indoor breathing zone TCE (and other halogenated hydrocarbon) concentrations.

EPA Method TO-15 and Summa® Canister Sampling

The atmosphere is sampled by introduction of air into a specially-prepared stainless steel canister initially under vacuum. A sample of air is drawn through a sampling train comprised of components that regulate the rate of sampling into the evacuated and passivated canister. After the air sample is collected, the canister valve is

closed, an identification tag is attached to the canister, and the canister is transported to the laboratory for analysis. To analyze the sample, a known volume of sample is directed from the canister through a solid multi-sorbent concentrator. After the concentration and drying steps are completed, the VOCs are thermally

desorbed, entrained in a carrier gas stream, and then focused in a small volume by trapping on a reduced temperature trap or small volume multisorbent trap. The sample is then released by thermal desorption and carried onto a gas chromatographic column for separation, and subsequently identified by mass spectrometry.