TECHNICAL MEMORANDUM NO. 5
MERCURY VAPOR INVESTIGATION

TAYLOR INSTRUMENTS FACILITY SITE INVESTIGATION
95 AMES STREET
ROCHESTER, NEW YORK

NOVEMBER 1997

ABB Environmental Services, Inc.

ASEA BROWN BOVERI

Technical Memorandum No. 5: Mercury Vapor Investigation
Taylor Instruments Facility Site Investigation

I. Introduction

ABB Environmental Services, Inc. (ABB-ES), on behalf of Combustion Engineering, Inc. (CE), is performing a site investigation at the Taylor Instruments facility located at 95 Ames Street, Rochester, New York. The general scope of the investigation is described in the Site Investigation Work Plan, August 1997, Taylor Instruments Site (ABB Environmental Services, Inc.)

To provide NYSDEC, NYSDOH, and MCDH with the preliminary investigation results as soon as possible and to create an environment for discussing conceptual clean-up goals for the Taylor site, ABB-ES will issue a series of Technical Memoranda (TM) as follows:

TM No. 1	Results of "full suite" (TCL VOCs, SVOC, pesticides/PCBs, TAL metals,) and waste classification (TCLP) analyses of soils.
TM No. 2	On-site and off-site sewer sampling.
TM No. 3	On-site and off-site soil gas sampling for VOCs.
TM No. 4	Overburden and bedrock groundwater investigations.
TM No. 5	Volatile mercury investigations.

Each TM will focus on summarizing the primary sample analytical results, and will provide only a limited amount of sampling effort documentation and interpretive discussion. As required by the Voluntary Cleanup Agreement (VCA) for the Taylor site, CE will submit the complete investigation results in an Investigative Report (IR). The IR will include a more thorough documentation of the work performed, summarize previous investigative activities, discuss QA/QC procedures and results, and expand upon and/or modify the initial, limited results discussion, interpretation and conclusions found in the TM.

This is Technical Memorandum No. 5.

II. Summary of Work Performed

As described in the Work Plan, several sampling techniques were used to evaluate mercury vapor presence.

Emissions Flux Measurements.

As described in the Work Plan, mercury vapor flux measurements were made in order to provide data to help assess the adequacy of the mathematical model previously used by ABB-ES to assess inhalation risk. Using a soil concentration as input, that model used a number of assumptions to generate an indoor air concentration of mercury in a future on-site structure. By making measurements which allow a direct calculation of mercury vapor flux - i.e., the rate at which mercury vapors are emitted from the soil surface - several assumptions within the mathematical model, which NYSDOH had suggested were subject to uncertainty, can be replaced with actual site-specific data.

The flux measurement work was performed by a team from the Environmental Sciences Division of Oak Ridge National Laboratory (ORNL). Although the flux estimation method is still considered to be in development, it nonetheless represents the most recognized, well-tested technique available for determining volatile mercury emissions from soils. The ORNL group are among the foremost researchers in the field.

As described in the Work Plan, measurements were made at locations where the asphalt and sub base material were removed in order to expose Site soil over an approximately five foot square area. A "flux chamber" designed by ORNL was then placed on this bare soil surface. The technique consists of making a series of measurements of the mercury concentration in air entering and leaving the flux chamber, using a very sensitive real-time instrument (Tekran® Mercury Analyzer Model 2537A). These measurements are then used to calculate an average mercury flux over the generally two hour measurement period, expressed in micrograms per square meter per hour[1].

In addition to the ten locations described in the Work Plan (SGM-1 through SGM-10; Figure 5-1, Attachment A) measurements were also obtained from four additional locations[2]. At locations SGM-12, SGM-13 and SGM-14, rather than removing the paving and sub base, the flux chamber was placed directly on the asphalt paving. These additional measurements were made in order to examine the effect of the asphalt paving on the vapor flux. Location SGM-16 was an exposed soil measurement similar to SGM-1 through SGM-10. These locations were all added simply on the basis of the ORNL group having the time available to make measurements beyond the ten proposed in the Work Plan. Similarly, time allowed duplicate or long-duration measurements to be made at several locations.

At several locations, instrument readings at the flux chamber outlet exceeded the Tekran's calibration range. In order to resolve these measurements, ORNL obtained from the Tekran manufacturer data from a series of calibrations above the instrument's normal operating range. These calibrations were then used to estimate the actual value of each "over-limit" measurement. (Although the instrument reports an over limit measurement, the peak area of the resulting detector output is still recorded and available for use.) The resulting flux estimates therefore are considered somewhat less quantitative than those derived solely from in-limit measurements and are therefore flagged with an "E" ("estimated").

Passive Soil Gas Measurements.

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[1] The calculated fluxes are reported in this technical memorandum. ORNL's detailed report, including details of all calculations, has not been received but will be provided with the IR.

[2] Location numbers are out of sequence because locations SGM-11 and SGM-15 were identified, but, due to time constraints, no measurements were made.

As described in the Work Plan, measurements of in-situ soil gas concentrations were made at SGM-1 through SGM-10 using EMFLUX passive soil gas sampling devices supplied by Quadrel Services, Inc. The EMFLUX technique is described in the Work Plan and in the data package provided by Quadrel included herein as Attachment B. As discussed in the Work Plan the EMFLUX method is not well-tested for mercury, although it operates on principles similar to its counterpart device which measures VOCs and which was used during the Taylor site investigation (see TM 3). Both because of its less well-tested state and because it requires more use of modeling assumptions which NYSDOH suggests are subject to uncertainty with respect to mercury, the EMFLUX devices were deployed only as a secondary or backup technique to ORNL's measurements.

As discussed in the Work Plan, the EMFLUX passive soil gas collection technique includes the deployment of the collectors during specific time windows that are calculated by the manufacturer to have greater potential for the movement (flux) of soil gas vapors through the subsurface. Based on Quadrel's recommendation, collectors were deployed at all locations on 8/29/97 and retrieved on 9/2/97. The EMFLUX devices were analyzed by Schneider Laboratories, Inc. of Richmond, Virginia, a laboratory contracted by Quadrel. Samples were analyzed using NIOSH Method 6009 for mercury.

Worker Exposure Characterization Sampling.

As described in the Work Plan, three test pits were excavated in order to make measurements under conditions intended to simulate what a utility/construction worker might encounter. As discussed in Section IV, the sampling conditions are believed to produce a very conservative assessment of potential worker exposure due to a sampling location three feet off the trench bottom being used to represent an 8-hour exposure, and the sampling runs which was performed within a covered trench.

Using NIOSH Method 6009 for mercury in air, measurements were made three times at each pit: immediately following initial excavation; after the pit had been covered for a minimum of eight hours, the measurement being made within the covered trench; and subsequent to cover removal. Simultaneous with sampling with the sorbent tubes following the NIOSH method a Jerome® Mercury Vapor Analyzer (MVA) was used to obtain real-time mercury vapor measurements.

Sorbent tubes were analyzed by Columbia Analytical Services, Inc. of Rochester, New York, an ELAP-approved laboratory, following the NIOSH method.

Soil Sampling.

Soil samples for mercury analysis were collected from the 11 flux/soil gas measurement test pit locations. At SGM-1 through SGM-10 samples were collected, using a hydraulic punch rig, from a depth of five feet below ground surface (bgs). At SGM-11, excavated after the others, the sample was collected from six inches bgs because the hydraulic punch had left the site.

Soil samples were also collected from each of the TP-1 through TP-3 locations. At TP-1, five individual samples were collected due to the presence of the glass shard layer in the trench and the expectation that mercury concentrations would vary greatly between each sample. At TP-2 and TP-3, soil from the four walls and bottom of the test pit was composited into a single sample as specified in the Work Plan. Soil samples were analyzed for total mercury by Columbia Analytical.

III. Results Summary

Emissions Flux Measurements.

Data from the flux chamber measurements, and the resulting calculated emissions fluxes, are provided in Attachment B, Table B-1.

There are no prescribed data quality criteria for the mercury-in-air measurements performed by the ORNL group. A standard instrument calibration routine was followed and documented in the instrument logs; this procedure checks instrument response to a primary mercury vapor standard. There is also a an internal calibration which the instrument automatically performs periodically.

Chamber "blanks" were run periodically during the field effort to determine whether the equipment itself was contributing to the chamber outlet measurement. Because all chamber blank measurements were low compared to the outlet measurements, the data set has not been blank-corrected. Although this could result in slight over-estimation of vapor flux in some cases, it is not believed to materially affect the subsequent hazard index (HI) calculations.

Passive Soil Gas Measurements.

Soil gas data reports provided by Quadrel are included in Attachment C.

ABB-ES' preliminary evaluation of blank and spike results reported with this data suggest its quality is acceptable.

Worker Exposure Characterization Sampling

A summary of sorbent tube results, and the calculated time-weighted average concentrations, are provided in Attachment D, Table D-1. ABB-ES' preliminary evaluation of sample and blank results suggest that the sorbent tube data is of acceptable quality.

Jerome MVA readings have not yet been compiled. As per the Work Plan, careful records were maintained of instrument calibration both by the manufacturer and by ABB-ES in the field. The instruments appeared to perform satisfactorily throughout the field effort.

Soil Sampling.

Results for soil sample analysis for total mercury, along with notes regarding sampling observations, are provided in Attachment E.

ABB-ES' preliminary evaluation suggests these data are of acceptable quality.

IV. Results Discussion and Initial Interpretation

The following discussion represents ABB-ES' initial data interpretation. Further data evaluation and data validation are required before definitive conclusions can be reached.

Mercury Vapor Measurements.

The primary objective of both the flux chamber measurements and the measurement of soil gas via the EMFLUX devices was to refine estimates of inhalation risk under a commercial/industrial future site use scenario. As was done previously (see *Voluntary Site Investigation, Ames Street Site: Volume II - Human Health Risk Assessment*, ABB Environmental Services, November, 1996) risk estimates assume that mercury vapors might migrate from soil into a slab-on-grade building's airspace.

General Data Observations

Figure 5-2 displays the calculated mercury vapor flux at each test location, along with generalized areas where elevated mercury concentration in soil occur. As would be expected, mercury vapor flux measurements are generally higher in those areas of the site with higher concentrations of mercury in soil. Outside those areas the mercury vapor fluxes are much lower.

The highest flux occured at SGM-16. While this flux occurs within an area of generally elevated mercury concentrations in soil, this measurement was also made within only a few hours of excavating the test location. (At other locations the test location was excavated a day or more before measurements were made.) ORNL's data analysis suggests that the vapor flux over the course of this measurement shows a downward trend, suggesting that a steady state had not yet been reached. All indications are that this measurement is decidedly worst-case.

Although the flux data correlate well with the broad pattern of distribution of mercury in Site soil, they do not correlate well with the specific mercury concentrations in the soil samples collected from the test locations themselves (Table E-1). Given the known variability in mercury concentration over small horizontal and particularly vertical distances at the Taylor Site, this lack of correlation is unsurprising.

Comparing the two pairs of bare soil and adjacent over-pavement measurements (SGM-

7/SGM-13 and SGM-8/SGM-14) shows that the over-pavement results are lower by two orders of magnitude in both cases. Although the soil and pavement measurement locations were only three to four feet apart, some variation in vapor flux probably does occur over relatively short horizontal distances. However, these data do seem to support the intuitive conclusion that placing pavement, concrete or other relatively low permeability materials over the soil surface would tend to reduce mercury vapor emissions.

The EMFLUX passive soil gas sampling detected mercury at only two locations, SGM-7 and SGM-8. Aside from SGM-16, where an EMFLUX device was not placed, these are the locations of highest vapor flux as measured by the flux chamber technique. This result suggests that the EMFLUX technique is a less sensitive method for measuring mercury vapor concentrations, but also tends to confirm that these locations represent areas of relatively higher soil gas concentrations and thus greater potential for vapor emissions from soil. Because ORNL's flux measurements are the more comprehensive data set, and require less modeling assumptions to utilize, it is the data set used for all health risk evaluations.

ABB-ES is currently awaiting further interpretation from ORNL regarding possible influence of environmental factors, such as ambient air or soil temperatures, on the flux measurements.

Initial Evaluation of Potential Health Risk.

Using the emission flux data in the mathematical model previously utilized to estimate inhalation risk requires only some simplifying modifications. The modified model incorporates the same building-specific parameters (e.g., area/volume ratio, crack factor, building air exchange rate) used in the VSI HHRA and TM 3 fate and transport models, but replaces the modeled vapor emission (from soil to building) with the measured flux. The equations used to estimate estimated indoor air concentration is:

$$CAindoor = \frac{Flux \times N \times t}{ER \times t} \times (IA/V)$$

where:
CAindoor = estimated indoor air concentration (ug/m^3)
Flux = measured mercury flux (ug/m^2/hr); value used = maximum recorded value (92,000 ug/m^2/hr)
IA/V = infiltration area to volume ratio; value used = 1/3 m (ASTM, 1995 value for commercial/industrial buildings)
N = building slab crack factor (unitless); value used = 0.0008 (derived in VSI HHRA)
t = infiltration time (hr); value used = 24 hr
ER = building air exchange rate (hr^{-1}); value used = 0.828/hr (ASTM, 1995 value for commercial/industrial buildings)

Using the maximum recorded mercury flux of 92,000 (E) ug/m^2/hr at location SGM-16, the corresponding estimated indoor air concentration is 28.4 ug/m^3. It is important to note that this modeled result represents a worst-case situation by assuming that a future building's entire footprint would be subject to the maximum vapor flux measured. In addition, as explained above, the SGM-16 flux measurement itself is thought to represent a worst-case value.

As described in the VSI HHRA, the RBSL for mercury in ambient air is the USEPA reference concentration (RfC) of 0.3 ug/m^3. This RfC represents the air exposure concentration, with an adequate margin of safety, at which no adverse health effects are expected to occur. The RfC is appropriate for comparing directly to the CAindoor for evaluating exposures to receptors who are assumed to be continuously exposed (i.e., 24 hours/day, 365 days/year). For evaluating exposures to receptors who are not continuously exposed, such as the commercial/industrial worker receptor evaluated in the VSI HHRA (workers who are assumed to work 8 hours per day for 250 days per year), the CAindoor must be adjusted to reflect the air concentration to which these receptors are assumed to be exposed, as follows:

$$CAexposure\ (mg/m^3) = \frac{CAindoor\ (mg/m^3) \times 250\ days/year \times 8\ hours/day}{365\ days/year \times 24\ hours/day}$$

The resulting CAexposure (6.5 ug/m^3, based on the maximum observed flux) is divided by the RfC (0.3 ug/m^3) to yield a hazard index (HI). The HI value for this evaluation, which is based on the maximum recorded mercury flux, is 22. As indicated by this relationship, HI values less than or equal to one indicate that the estimated indoor air concentration to which a commercial/industrial worker may be exposed does not exceed the "safe" exposure concentration. HI values greater than one indicate a greater likelihood of adverse effects. The flux value which corresponds an HI equal to 1 is 4,200 ug/m^2/hr.

As shown in Table B-2, HI values corresponding to flux measurements recorded at all locations aside from SGM-16 are well below 1. It therefore appears that, with the possible exception of certain locations within areas exhibiting the highest concentrations of mercury in soil, mercury vapor emissions would not pose an unacceptable inhalation risk to future commercial/industrial workers occupying buildings constructed at the Site.

Worker Exposure Characterization

The worker exposure characterization was intended to establish whether future construction or utility workers might face an inhalation risk when working at the Taylor Site, and in what areas.

General Data Observations

As described in the Work Plan and as shown on Figures 5-1 and 5-2, the three test trench locations were excavated at areas thought to contain significant concentrations of mercury in soil, and therefore represent locations with relatively high potential for mercury to be present in air following excavation.

Locations TP-1 and TP-2 clearly did represent "worst-case" locations. At both, glass shard wastes were present in one or more excavation sidewalls. As shown in Table E-1, mercury concentrations in soil samples collected from these two trench sidewalls ranged from 82 mg/kg in the TP-2 composite sample (noting that none of the five composite aliquots included any of the shard waste itself, however) up to 45,300 mg/kg in the sample of the shard-bearing soil collected from TP-1[3].

The composite soil sample from location TP-3, located in the area of former Building 44 in which mercury was extensively present in flooring and drain lines (removed during facility demolition) contained only 0.25 mg/kg total mercury (0.4 mg/kg in duplicate sample). Although again it is not believed that any single soil sample is necessarily representative of the broad pattern of mercury occurrence, TP-3 is located in an area of relatively lower mercury concentration compared to TP-1 and TP-2.

Examination of the sampling results, and of the Jerome MVA monitoring record, shows that the subsequent air measurements correspond well with the observations of glass shard wastes and the mercury concentrations in soils. TP-1 exhibited the highest levels of airborne mercury, followed by TP-2 and then by TP-3, which exhibited little to no measurable airborne mercury.

The air sampling results are also consistent with the nature of three exposure scenarios, i.e., sampling immediately after excavation, in the covered trench following the trench being covered for at least eight hours, and immediately after cover removal. At each location where mercury was detected, the covered trench results are highest, followed by the results immediately following excavation when evolved soil gas would tend to be released and mercury in soil would be first exposed to the ambient air. The lowest results occurred after the trench had been open for a period of time and had potentially reached a steady-state situation in terms of mercury vapor outgassing.

Initial Evaluation of Potential Health Risk

Three potentially applicable limits for construction or utility workers were identified to compare to the sampling results from the exposure simulation[4]. The first is OSHA's acceptable ceiling concentration for mercury, which is 0.1 mg/m^3 and represents the concentration which should not be exceeded for even a short period of time. The second and third standards are the ACGIH threshold limit value (TLV) and NIOSH recommended exposure limit (REL) of 0.025 mg/m^3 and 0.05 mg/m^3, respectively. Unlike the OSHA

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[3] This is the highest mercury concentration observed at the Taylor site; however, it is one of the few samples ever retrieved directly from the visible glass shard-bearing layer. Note that sample PSM0106C, retrieved from soil just a few inches below the glass shard layer, contains only 18 mg/kg total mercury.

[4] Comparison to EPA's RfC for mercury is considered inappropriate for the sub-chronic construction worker exposure scenario, but at NYSDOH's request will be made in the IR.

ceiling concentration, these are time-weighted average (TWA) concentrations to which most workers may be repeatedly exposed, day after day, for a conventional 8-hour workday and a 40-hour workweek, without adverse effect.

Results from TP-1 (Table D-1) immediately following trench excavation were higher than the short term ceiling and TWA limits. Although the measured values are substantial, these results are clearly worst-case given that they assume a long-duration exposure to air three feet from the trench bottom.

Not surprisingly, TP-1 also produced results exceeding the standards during the covered trench scenario. Results also exceeded the OSHA, NIOSH and ACGIH standards after the cover was removed.

MVA monitoring results from the sorbent tube sample collection point at TP-1 showed similarly elevated concentrations during all three exposure scenarios. However, readings in the breathing zone above the top of the trench, including downwind of the trench and excavated soil pile, always remained below the standards.

Results from TP-2, again measured three feet off the trench bottom, only reached one-half to two-thirds the OSHA ceiling limit, even during the covered trench scenario (results from primary and duplicate samples). Following initial trench excavation, the sampling result of 0.040 mg/m^3 was above ACGIH's but below NIOSH's limit. However, after trench uncovering the sorbent tube sampling results, which did not detect any mercury above the MDL of .075 ug/tube and the Jerome, which measured airborne concentrations ranging from .007 to .01 mg/m^3 at the same in-trench location, demonstrated that concentrations were well below the applicable limits.

Neither the sorbent tube sampling nor Jerome MVA monitoring at TP-3 detected significant mercury; mercury in air at that location were far below all of the standards.

In ABB-ES' opinion, averaging the measured air concentrations of mercury immediately after excavation and after removal of the cover provides a more realistic, but still very conservative, estimation of an 8-hour exposure concentration. (Again, in ABB-ES' opinion, the covered trench sampling results simply do not represent a realistic exposure scenario.) At TP1, this average concentration is 0.712 mg/m3, which exceeds both TWA standards. At TP2, this average concentration (calculated by combining the post-excavation concentration of 0.040 mg/m3 with the sorbent tube detection limit of 0.075 ug/0.03 m3, or 0.0025 mg/m3) is 0.021 mg/m^3 , below both ACGIH's TLV and NIOSH's REL. Although the average result is not significantly below the ACGIH benchmark, assuming an eight hour exposure to air three feet above the trench floor is a very conservative exposure scenario.

Preliminary Interpretive Conclusions.

Based on the data evaluation conducted to date, ABB-ES has reached the following preliminary conclusions:

1. The mercury vapor flux data is of sufficient quality, and displays an appropriate consistency with the broad pattern of mercury in Site soils, that it is appropriate to use as a replacement for previous assumptions in the fate and transport model used to estimate potential future inhalation risks. Similarly, the sorbent tube sampling data is of sufficient quality and consistency with the Jerome MVA data that it can be compared with promulgated worker exposure standards.

2. Under current site conditions, mercury vapor emissions from all or most of the Taylor site surface would not produce an inhalation threat to occupants of a future industrial/commercial structures of slab-on-grade construction. Only the single highest flux measurement - believed to represent a worst-case result - yields a calculated potential inhalation threat to a future industrial/commercial use. Although the current data set is not sufficient to conclude whether or not an actual threat might exist assuming that no mercury remediation occurred, it appears that it is unlikely.

3. The flux estimate data suggest that the previously utilized mathematical model probably does not underestimate the potential inhalation threat based on a given concentration of mercury in soil. A remedial approach which removes or isolates soils containing mercury below the model-predicted level of approximately 4,000 mg/kg is likely to permanently preclude the potential for a future inhalation threat to a commercial/industrial land use with the type of slab-on-grade construction the model assumes.

4. Under current site conditions, construction/utility worker exposure to mercury vapors is likely to exceed applicable worker exposure standards only in relatively limited areas of highest average mercury concentrations, e.g., where substantial glass shard waste is present in an excavation. Such potential exposures could be easily mitigated through use of standard health and safety procedures such as mechanical ventilation.

Attachment A
Figure 5-1, Sampling Locations
Figure 5-2, Mercury Vapor Flux Measurements

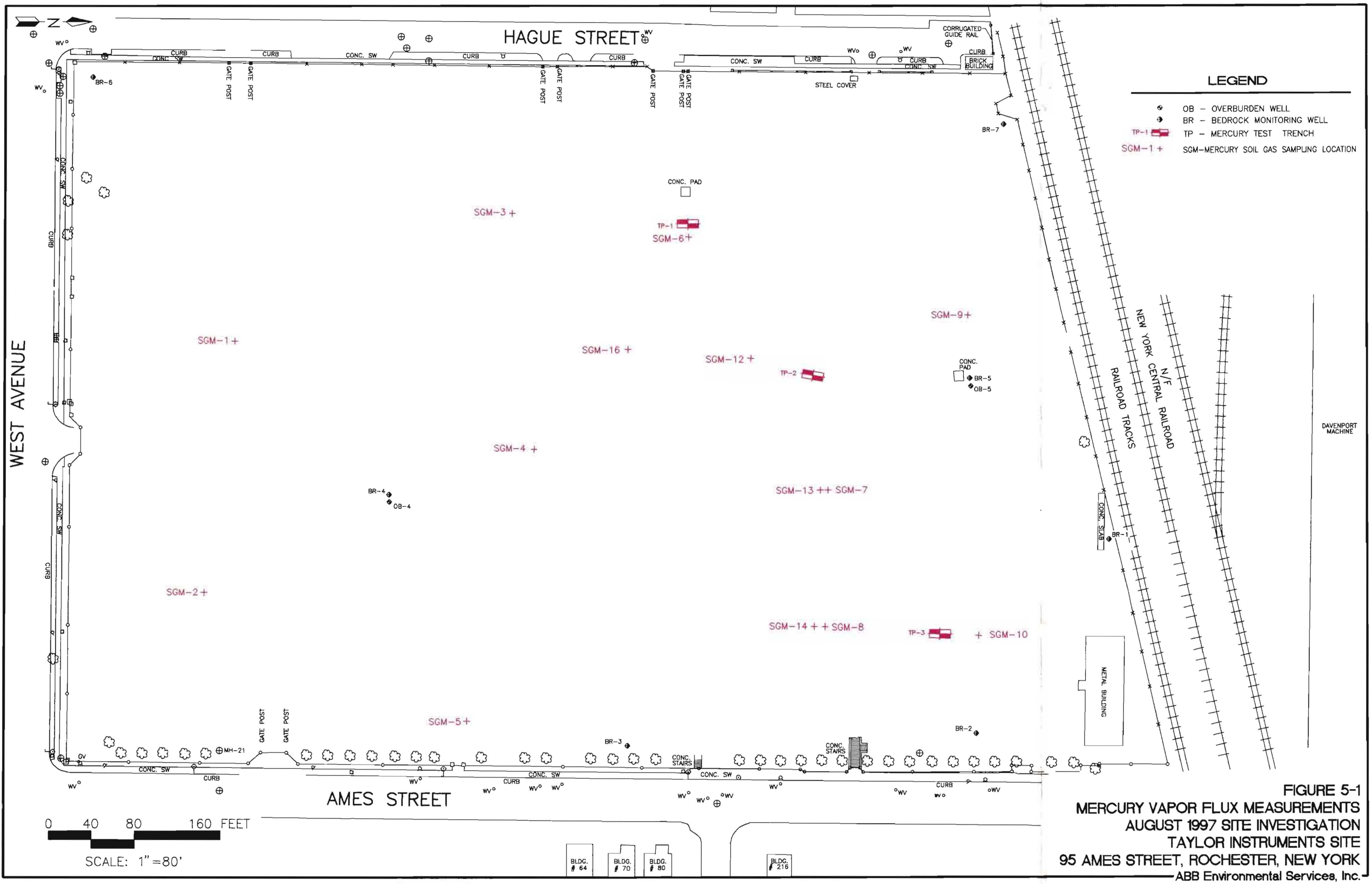


FIGURE 5-1
MERCURY VAPOR FLUX MEASUREMENTS
AUGUST 1997 SITE INVESTIGATION
TAYLOR INSTRUMENTS SITE
95 AMES STREET, ROCHESTER, NEW YORK

ABB Environmental Services, Inc.

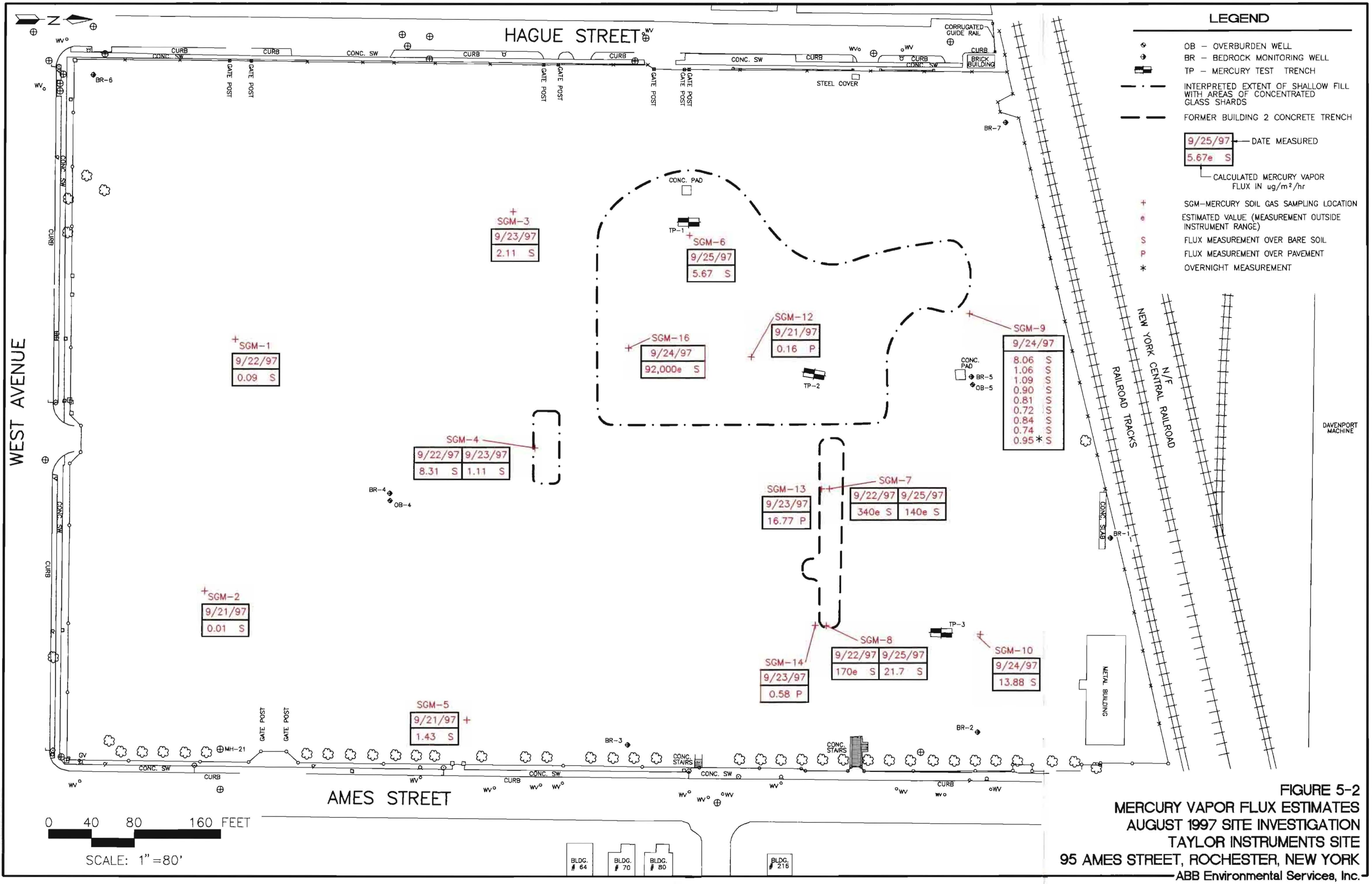


FIGURE 5-2
MERCURY VAPOR FLUX ESTIMATES
AUGUST 1997 SITE INVESTIGATION
TAYLOR INSTRUMENTS SITE
95 AMES STREET, ROCHESTER, NEW YORK
ABB Environmental Services, Inc.

Attachment B
Flux Chamber Measurements and Emissions Flux Estimates
Hazard Index Calculations

TABLE B-1

Summary of Flux Chamber Measurements and Calculated Vapor Fluxes

Taylor Instruments Facility Site Investigation

DATE	TIME	LOCATION	DURATION (MINUTES)	FLUSH (L/MIN)	<INLET> (ng/m3)	INLET STDEV	INLET N	<OUTLET> (ng/m3)	OUTLET STDEV	OUTLET N	FLUX (ug/m2/hr)	COMMENT
9/20/97	1620-1715	TRAILER	60	4.8	33.2	6.2	6	37.2	7.2	6	0.02	CHAMBER BLANK
9/21/97	0915-1110	SGM-5	120	4.8	15.0	5.8	12	469	103	12	1.43	
9/21/97	1125-1340	SGM-2	140	4.8	3.4	0.4	14	5.84	1.17	14	0.01	
9/21/97	1355-1550	SGM-12	120	4.8	4.8	2.6	12	56.00	27.8	12	0.16	PAVEMENT
9/22/97	0810-1005	SGM-1	120	4.8	5.3	1.0	12	33.3	11.1	12	0.09	
9/22/97	1220-1255	SGM-7	40	17.6	1960.5	540.8	4	86000	200	4	340E	MEASUREMENT WAS OVER THE INSTRUMENT LIMIT
9/22/97	1340-1355	AFTER SGM-7	20	4.8	16.4	0.7	2	25.6	0.7	2	0.030	CHAMBER BLANK
9/22/97	1510-1545	SGM-8	40	23.3	1196.2	698.7	4	14000	300	4	170E	MEASUREMENT WAS OVER THE INSTRUMENT LIMIT
9/22/97	1555-1605	AFTER SGM-8	15	23.3	48.5	0.0	1	57.9	6.2	2	0.12	CHAMBER BLANK
9/22/97	1645-1820	SGM-4	110	17.6	59.9	14.0	10	912	112	10	8.31	
9/23/97	0735-0930	SGM-13	120	17.6	182.2	67.2	12	1900	88.4	12	16.77	PAVEMENT NEAR SGM-7
9/23/97	0940-0950	AFTER SGM-13	15	17.6	5.9	0.0	1	13.9	0.4	2	0.08	CHAMBER BLANK
9/23/97	0955-1240	SGM-14	170	17.6	16.4	7.7	16	73.6	10.7	15	0.58	PAVEMENT NEAR SGM-8
9/23/97	1245-1300	AFTER SGM-14	20	17.6	5.8	1.3	2	8.7	0.7	2	0.03	CHAMBER BLANK
9/23/97	1345-1605	SGM-3	85	17.6	48.5	10.8	14	265	58	13	2.11	
9/23/97	1620-1830	SGM-4	135	17.6	27.5	8.3	12	141	50	12	1.11	
9/24/97	0855-1050	SGM-10	120	17.6	77.9	22.5	12	1500	101	12	13.88	
9/24/97	1135-1330	SGM-16	120	17.6	5100.0	400.0	12	9500000	1900	12	92000E	MEASUREMENT WAS OVER THE INSTRUMENT LIMIT
9/24/97	1400-1450	AFTER SGM-16	55	17.6	42.1	24.4	5	121	27.4	6	0.77	CHAMBER BLANK
9/24/97	1520-1730	SGM-9	135	17.6	132.6	35.7	13	958.0	453.0	14	8.06	
9/24/97	1805-2005	SGM-9	120	16.0	40.8	10.0	12	220.0	40.2	12	1.60	
9/24/97	2005-2205	SGM-9	120	16.0	23.4	6.0	12	145.0	11.4	12	1.09	
9/24/97	2205-0005	SGM-9	120	16.0	15.3	1.6	12	118.1	6.9	12	0.90	
9/25/97	0005-0205	SGM-9	120	16.0	17.4	1.0	12	107.6	4.6	12	0.81	
9/25/97	0205-0405	SGM-9	120	16.0	16.0	1.1	12	97.2	4.8	12	0.72	
9/25/97	0405-0605	SGM-9	120	16.0	13.8	2.6	12	85.7	3.1	12	0.84	
9/25/97	0605-0805	SGM-9	120	16.0	12.5	1.4	12	95.1	12.4	12	0.74	
9/24-9/25	1755-0650	SGM-9	780	16.0	20.6	10.5	78	127	48.0	78	0.95	OVERNIGHT MEAN
9/25/97	0715-0910	SGM-6	120	16.0	86.8	19.4	12	723	68	12	5.67	
9/25/97	0950-1255	SGM-7	190	16.0	823.7	573.1	20	18000	300	18	140E	MEASUREMENT WAS OVER THE INSTRUMENT LIMIT
9/25/97	1350-1435	AFTER SGM-7	50	16.0	13.9	4.7	6	27.4	4.2	4	0.12	CHAMBER BLANK
9/25/97	1520-1815	SGM-8	180	16.0	57.2	33.1	18	2500	144	18	22.3	

NOTES:

<> = MEAN CONCENTRATION

L = LITERS

N = TOTAL NUMBER OF MEASUREMENTS

OL = TEKRAN INSTRUMENT OVER LIMIT; NO READING

NC = NOT CALCULATED

E = ESTIMATED CONCENTRATION, MEASURED OUTLET VALUE EXCEEDED INSTRUMENT LIMIT

TABLE B-2

Summary of Hazard Index Values Associated with Mercury Flux Measurements
Full-Time Commercial/Industrial Worker - Indoor Air Exposures

DATE	LOCATION	FLUX UG/M^2/HR	ASSOCIATED HAZARD INDEX (HI) [a]	COMMENT
9/21/97	SGM-5	1.43	0.0003	
9/21/97	SGM-2	0.01	0.000002	
9/22/97	SGM-1	0.09	0.00002	
9/22/97	SGM-4	8.31	0.002	
9/22/97	SGM-7	340 E	0.08	
9/22/97	SGM-8	170 E	0.04	
9/23/97	SGM-3	2.11	0.0005	
9/23/97	SGM-4	1.11	0.0003	Repeat measurement
9/24/97	SGM-10	14	0.003	
9/24/97	SGM-9 [b]	8.06	0.002	
9/24-9/25	SGM-9	0.96	0.0002	Mean values from 9 sequential measurements
9/24	SGM-16	92000 E	22	
9/25/97	SGM-6	5.67	0.001	
9/25/97	SGM-7	140 E	0.03	
9/25/97	SGM-8	21.8	0.005	

Notes:

[a] Hazard index calculated by dividing the measured flux by the flux that corresponds to a hazard index equal to one. Flux @ HI = 1 is 4200 ug/m^2/hr over bare soil. Based on full-time commercial/industrial worker exposed via inhalation to vapor migrating into indoor air space; calculated as described in memo text.

[b] Highest reading among eight sequential 2-hour interval readings.

HI not calculated for chamber blanks or over-pavement measurements (no risk evaluation value)

E - estimated measurement, due to exceedance of instrument calibration range (see text)

Attachment C
Quadrel Soil Gas Data Report

Quadrel Report No. QS2319M

EMFLUX® Passive, Non-Invasive Soil-Gas Survey

AMES ST./TAYLOR SITE
NEW YORK

Prepared for

ABB Environmental Services, Inc.
1400 Centerpoint Blvd
Suite 158
Knoxville, TN 37932

by

Quadrel Services, Inc.
1896 Urbana Pike
Suite 20
Clarksburg, MD 20871

September 19, 1997

Applying Results from Soil-Gas Surveys

The utility of soil-gas surveys is directly proportional to their accuracy in reflecting and representing changes in the subsurface concentrations of source compounds. A soil-gas survey, however, measures vapor-phase concentrations; and vapor-phase concentrations are never equivalent to the concentrations of their source compounds, essentially being dilute "extracts" of those compounds. As a matter of convenience, therefore, the units used in reporting volatile detections are usually smaller than those employed for source-compound concentrations. For example, where source concentrations are expressed in mg/kg (or parts per million), concentrations of the derivative gas may more conveniently be measured in nanograms per liter (parts per trillion).

The critical fact is that, whatever the relative concentrations of source and associated soil gas, best results are realized when the ratio of soil-gas measurements to actual subsurface concentrations remains as close to constant as the real world permits. It is the reliability and consistency of this ratio, not the particular units of mass (*e.g.*, nanograms) or units of concentration (*e.g.*, ng/L) that determine usefulness. Thus, Quadrel emphasizes the necessity of conducting -- at minimum -- follow-on intrusive sampling at one or two points which show relatively high EMFLUX® values to obtain corresponding concentrations of soil and ground-water contaminants. These correspondent values furnish the basis for approximating the required ratio. Once that ratio is established, it can be used in conjunction with EMFLUX® measurements (regardless of the units adopted) to estimate subsurface contaminant concentrations across the survey field. It is important to keep in mind, however, that specific conditions at individual sample points, including soil porosity and permeability, depth to contamination, and perched ground water, can have significant impact on soil-gas measurements at those locations.

When EMFLUX® Surveys are handled in this way, the data provide information which can yield substantial savings in drilling costs and in time. They furnish, among other things, a checklist of compounds expected at each survey location and help to determine how and where drilling budgets can most effectively be spent.

EMFLUX® Survey Number: QS2319M

Ames St./Taylor Site
New York

This EMFLUX® Soil-Gas Survey Report has been prepared for ABB Environmental Services, Inc. by Quadrel Services, Inc. (Quadrel) in accordance with the terms of Purchase Order No. SE725161 dated August 20, 1997. Quadrel's principal technical contact at ABB for this project has been Mr. Geoff Knight.

1. Objectives

To screen the Ames St./Taylor Site for the presence of Mercury in the gas phase. Results will be used to profile contamination in soil and/or ground water at the site, thereby determining the distribution and relative strength of detected contaminants.

2. Target Compounds

This survey targeted Mercury and the resulting laboratory data in micrograms (µg) per cartridge are provided in **Attachment 1.**

3. Survey Description

No. of Field Sample Points:	10
No. of Ambient-Air Control Samples:	1
No. of Trip Blanks:	1
Total No. of EMFLUX® Cartridges:	12

4. Field Work

Quadrel provided ABB an EMFLUX® Field Kit with the equipment needed to conduct a 10-point EMFLUX® Soil-Gas Survey. Collectors were deployed on August 29, 1997 and retrieved September 2, 1997. **Attachment 2** describes the field procedures used. Individual deployment and retrieval times will be found in the Field Deployment Report (**Attachment 3**).

5. Schneider Laboratories Analysis and Reporting Dates

- Schneider Laboratories received 12 sample cartridges for analysis on September 3, 1997.
- EMFLUX® samples cartridges were digested using nitric and hydrochloric acid. The Mercury was then reduced to elemental Mercury using stannous chloride and was then analyzed using a cold vapor-atomic absorption spectrophotometer in accordance with OSHA Method ID-140 (**Attachment 4**).
- Schneider Laboratories completed the analysis on September 10, 1997.
- Quadrel received Schneider Laboratories data on September 11, 1997, which was provided to ABB the same day.

6. Data Treatment

- **Table 1** provides the survey results in soil-gas concentrations in nanograms per liter (ng/L, or parts per trillion). Laboratory values were converted to soil-gas concentrations using the following formula:

$$C = 10^3 KW/TR$$

where: C = Avg. soil-gas conc. in collector (ng/L)
K = Cartridge collection constant (0.34 sec/cm^3)
W = Contaminant mass (ng)
T = Collection period (sec)
R = Adsorbent recovery factor (decimal fraction)

The specific collection period for each sample is given in the Field Deployment Report. The adsorbent recovery factor for Mercury is 0.98, and values in **Table 1** have been corrected for this recovery factor.

Note: Quadrel's derivation of the EMFLUX® cartridge collection constant, K, involved (i) adoption of 0.145 cm^2/sec as a typical diffusion coefficient, D, for Mercury in free air and (ii) evaluation of experimental laboratory data to determine the ratio between collection area, A, and diffusion distance, Z. The latter relationship, based on work done to date, appears to be A/Z = 20.2 cm. Given these values, Quadrel has computed the value of the constant to be:

$$\begin{aligned} K &= 1/[D(A/Z)] \text{ sec/cm}^3 \\ &= 1/[0.145(20.2)] \text{ sec/cm}^3 \\ &= 1/2.93 \text{ sec/cm}^3 \\ &\approx 0.34 \text{ sec/cm}^3 \end{aligned}$$

7. Report Notes and Quality Assurance/Quality Control Factors

- **Table 1** provides survey results in soil-gas concentrations for Mercury by sample-point number. The quantitation levels (Q.L.) represent values above which quantitative laboratory results can be achieved within specified limits of precision and with a high degree of confidence. The quantitation level, therefore, provides a reliable basis for comparison of the relative strength of individual detections of that compound.

- The **Chain-of-Custody** form, which was shipped with the samples for this survey, is supplied as **Attachment** 5.

- **Laboratory QA/QC procedures** included standards, surrogates, and blanks appropriate to OSHA Method ID-140. Field work and reporting were done in accordance with Quadrel's Quality Assurance Program Plan. Schneider Laboratories performed analyses under the laboratory's own Quality Assurance Plan.

- **QA/QC Contaminant Corrections.** Following EPA guidelines, Quadrel does not correct EMFLUX® laboratory data for method blank or trip blank contamination values. All contamination detected on QA/QC samples is reported (**Attachment 1**). Subsequent actions taken regarding QA/QC sample contamination are dependent upon the circumstances and origin of the sample; all corrective conventions recommended here have, in Quadrel's experience, proved useful in deriving highly accurate and reproducible interpretations of survey data. *No alternative thus far tested has produced comparable levels of quality.*

  The **trip blank** is an EMFLUX® cartridge prepared, transported, and analyzed with other samples but intentionally not exposed. Although reported in the laboratory data, contamination on this field QA/QC sample is subtracted from measurements of the same compounds on field samples during data interpretation. Here, the trip blank (labeled Trip-2 in **Attachment 1**) did not record any Mercury, indicating that the site is the source of detected contamination.

  Control samples are field QA/QC samples which serve to identify compounds present in ambient air during deployment and retrieval of collection devices. During data interpretation, contamination found on the control samples is subtracted from measurements of the same compounds on field samples prior to their conversion to soil-gas concentrations; however, the control sample (trap B in **Attachment 1**) did not record any Mercury, indicating that ambient air is not the source of detected contamination.

- **Survey findings** are relative exclusively to this project and should not routinely be compared with results of other EMFLUX® Surveys. *To establish a relationship between reported soil-gas concentrations and actual subsurface contaminant concentrations, which will indicate those* *detections representing significant subsurface contamination, Quadrel recommends the guidelines on the inside front cover of this report.*

- The following **Attachments** are included:

  -1- Laboratory Report
  -2- EMFLUX® Field Procedures
  -3- Field Deployment Report
  -4- Laboratory Procedures
  -5- Chain-of-Custody Form

Table 1

Soil-Gas Concentrations (ng/L)
Ames St./Taylor Site
New York

SAMPLE LOCATION	Q.L.	1	2	3	4	5
CONTAMINANT						
Mercury	0.05	--	--	--	--	--

SAMPLE LOCATION	Q.L.	6	7	8	9	10
CONTAMINANT						
Mercury	0.05	--	0.87	0.05	--	--

NOTES:
1) Values listed under "Q.L." are reported soil-gas concentration quantitation levels.
2) "--" denotes absence of detections above the reported quantitation level.

Attachment 1

Laboratory Report

SCHNEIDER LABORATORIES

INCORPORATED

2512 W. Cary Street • Richmond, Virginia • 23220-5117
804-353-6778 • 800-785-LABS (5227) • (FAX) 804-353-6928

Excellence in Service and Technology
AIHA 8936, ELLAP 8936, NVLAP 1150, NYELAP 11413, CAELAP 2078

LABORATORY ANALYSIS REPORT

Air Filter Mercury Analysis by NIOSH 6009 Method

ACCOUNT #:	1363-97-2	**DATE COLLECTED:**	8/29/97
CLIENT:	QUADREL SERVICES, INC.	**DATE RECEIVED:**	9/3/97
ADDRESS:	1896 URBANA PIKE, SUITE 20 CLARKSBURG, MD 20871	**DATE ANALYZED:**	9/10/97
		DATE REPORTED:	9/11/97
PO NO.:			
PROJECT NAME:	Ames St./Taylor		
PROJECT NO.:	2319		
JOB LOCATION:	95 Ames Street	**SAMPLE TYPE:**	AIR

SLI Sample No.	Client Sample No.	Sample Description	Sample Time (min)	Dil Factor	Total Mercury (μg)*	
1119270	SGM-1		290.00	1	< 0.05	
1119271	SGM-2		281.00	1	< 0.05	
1119272	SGM-3		284.00	1	< 0.05	
1119273	SGM-4		273.00	1	< 0.05	
1119274	SGM-5		270.00	1	< 0.05	
1119275	SGM-6		271.00	1	< 0.05	
1119276	SGM-7		260.00	1	0.91	
1119277	SGM-8		249.00	1	0.05	
1119278	SGM-9		249.00	1	< 0.05	
1119279	SGM-10		235.00	1	< 0.05	
1119280	B		235.00	1	< 0.05	
1119281	Blank Trip-2			1	< 0.05	
1119282	Blank QA/QC			1	< 0.05	
	QC - 5284	0.020 ppm QC Spex			1.95	97.7%
	QC - 5284	1.0 μg Air Spike			0.88	88.4%
	QC - 5284	Air Blank			< 0.05	

ANALYST: MICHAEL A. MUELLER

REVIEWED BY Michael A. Mueller, Dept. Head

NOTE: Results below the Minimum Reporting Limit have been calculated according to the client's request.
OSHA PEL for 8h TWA is 0.025 mg/m³ [25 μg/m³].
Minimum Reporting Limit: 0.01 μg Total Mercury *For true values assume two (2) significant figures.
Standard and spike values are reported as percent recovery for QC purposes.
Exposure calculations are based on client-supplied information and assume zero exposure for time not sampled.
All testing is performed in strict accordance with Schneider Laboratories, Inc. protocol.

Attachment 2

FIELD PROCEDURES FOR EMFLUX® SOIL-GAS SURVEYS

The following field procedures are routinely used during EMFLUX® Soil-Gas Surveys. Modifications can be and are incorporated from time to time in response to individual project requirements. In all instances, Quadrel adheres to EPA-approved Quality Assurance and Quality Control practices.

A. Field personnel carry EMFLUX® system components and support equipment to the site and deploy the EMFLUX® Collectors in a prearranged survey pattern. Although EMFLUX® Collectors require only one person for emplacement and retrieval, the specific number of field personnel required depends upon the scope and schedule of the project. Each Collector emplacement generally takes less than two minutes.

B. For those sample locations covered with soils or vegetation, a field technician clears vegetation and debris exposing the ground surface. Using a hammer and a ¾-inch-diameter pointed metal stake, the technician creates a hole approximately three inches deep. For those locations covered with an asphalt or concrete cap, the field technician drills a one-inch-diameter hole through the cap to the soils beneath. (If necessary, the Collector can be sleeved with a ¾-inch i.d. copper pipe for either capped or uncapped locations).

C. The technician then removes the solid plastic cap from an EMFLUX® Collector (a glass vial containing an adsorbent cartridge with a length of wire attached to the vial for retrieval) and replaces it with a Sampling Cap (a plastic cap with a hole covered by screen meshing). The technician inserts the Collector, with the Sampling Cap end facing down, into the hole (**see attached figure**). The Collector is then covered with either local soils for uncapped locations or, for capped locations, aluminum foil and a concrete patch. The Collector's location, time and date of emplacement, and other relevant information are recorded on the Field Deployment Form.

D. As a quality-control check during emplacement and retrieval, the technician takes periodic ambient-air control samples and records the date, time, and location of each. (One or more trip blanks are also included as part of the quality-control procedures).

E. Once all EMFLUX® Collectors have been deployed, field personnel schedule Collector recovery (approximately 72 hours after emplacement) and depart, taking all no-longer-needed equipment and materials with them).

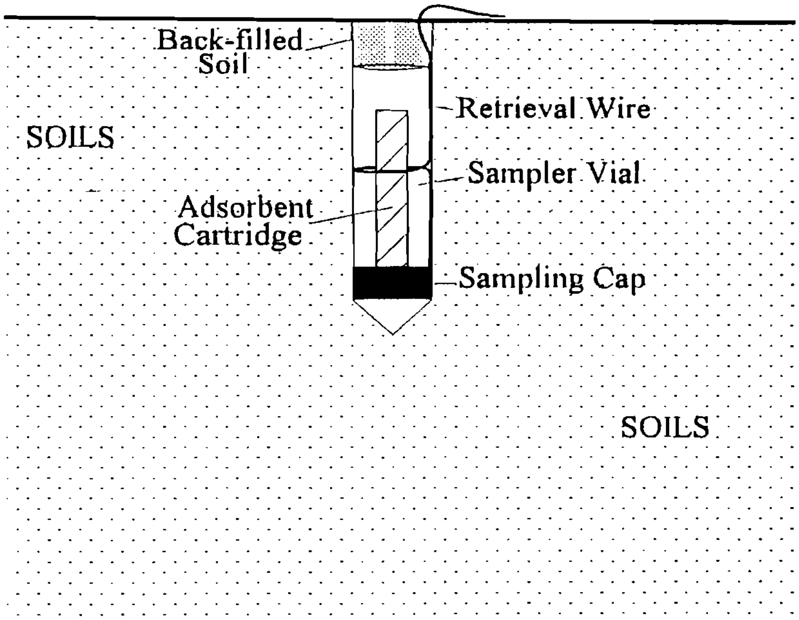
F. Field personnel retrieve the Collectors at the end of the 72-hour exposure period. At each location, a field technician withdraws the Collector from its hole and wipes the outside of the vial clean using gauze cloth; following removal of the Sampling Cap, the threads of the vial are also cleaned. A solid plastic cap is screwed onto the vial and the sample location number is written on the label. The technician then records sample-point location, date, time, etc. on the Field Deployment Form.

G. Sampling holes are refilled with soil, sand, or other suitable material. If Collectors have been installed through asphalt or concrete, the hole if filled to grade with a plug of cold patch or cement.

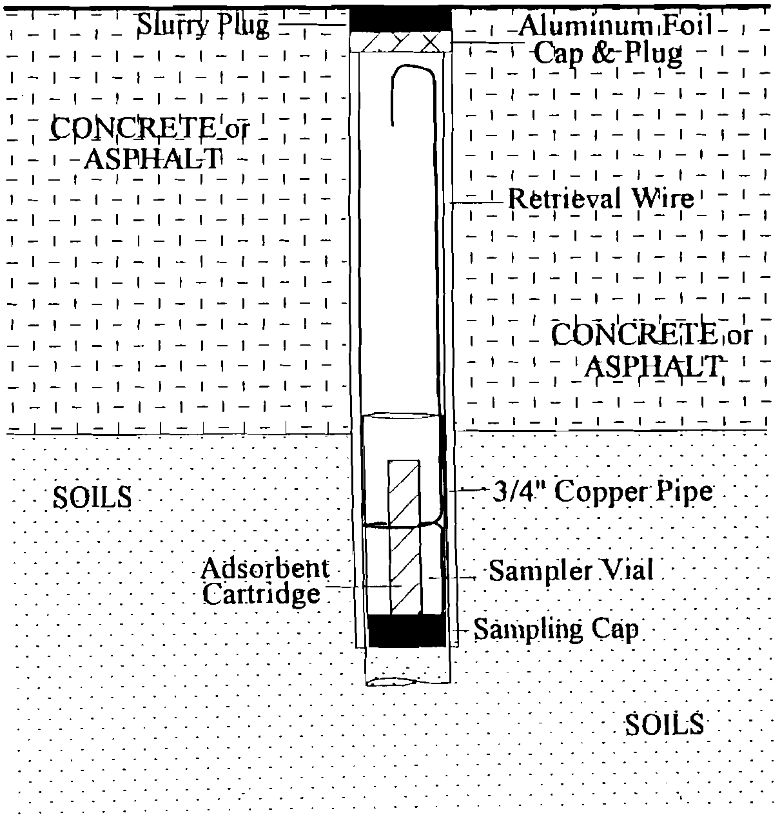
H. Following retrieval, field personnel ship or carry the EMFLUX® Collectors to analytical laboratories under contract to Quadrel Services. The remaining equipment is returned to Quadrel's preparation facility.

EMFLUX® COLLECTOR

DEPLOYMENT THROUGH SOILS



DEPLOYMENT THROUGH AN ASPHALT/CONCRETE CAP



Attachment 3

Field Deployment Report

white caps

30 - 9 - 2

QUADREL SERVICES, INC.
FIELD DEPLOYMENT REPORT

PROJECT #: 2319	CLIENT: ABB	SITE: Ames St. / Taylor

INDIVIDUAL SAMPLE INFORMATION

EMPLACEMENT DATE: 8/29/97

RETRIEVAL DATE: 9/2/97

SAMPLE NUMBER	TIME		FIELD NOTES (*e.g.*, asphalt/concrete covering, description of sample location, cartridge/vial condition)
	Emplaced	Retrieved	
SGM1	8/29/97 1300 hrs	1750	Little mud on vial exterior
SGM2	1315 hrs	1756	
SGM3	1320 hrs	1804	
SGM4	1335 hrs	1808	Cartridge wet and muddy; set in water.
SGM5	1345 hrs	1815	Cartridge wet and muddy.
SGM6	1355 hrs	1826	
SGM7	1410 hrs	18~~27~~ ok 30	
SGM8	1425 hrs	1834	
SGM9	1435 hrs	1844	
SGM10	1445 hrs	1840	
B	1445	1840	Collected at point # SGM-10
Trip-2	—	—	Do not open (Also loose vial QA/QC Blank included)

Attachment 4

LABORATORY PROCEDURES FOR MERCURY ANALYSIS OF EMFLUX® ADSORBENT CARTRIDGES

Following are laboratory procedures used with the EMFLUX® Soil-Gas System, a screening technology for expedited site investigation. After exposure, EMFLUX® cartridges are analyzed following OSHA Method ID-140, modified to accommodate EMFLUX® adsorbent cartridges containing Carulite®. This procedure is summarized below:

A. EMFLUX® cartridges are digested using nitric acid and hydrochloric acid. The Mercury in the sample is reduced to elemental Mercury using stannous chloride and is then analyzed using a cold vapor-atomic absorption spectrophotometer.

B. The laboratory uses the following instrumentation and reagents to perform the analysis:

Instrumentation:
PE-Atomic Absorption Spectrophotometer (Model 603)
PE MHS-10

Lamp:
PE-Hollow Cathode Lamp

Reagents:
DI Water-Carbon and Mixed Bed Filters (Supplier - Ion Pure)
Hydrochloric Acid-Concentrated (Supplier - Fisher Scientific)
Mercury Standard Stock Solutions 1,000 μg/mL (Suppliers - EM Science & Ultra Scientific)
Nitric Acid-Concentrated (Supplier - Fisher Scientific)
Stannous Chloride (Supplier - Fisher Scientific)
*All reagents are at least reagent grade.

C. Laboratory personnel conduct internal control blank and internal control verification analyses every 12 hours to ensure that the system is contaminant free and properly calibrated. The system is calibrated using the external standard calibration procedure to at least five different concentration levels, with the lowest concentration level at or near the method detection limit.

Attachment 5

Chain-of-Custody Form

1363-97-2

QUADREL SERVICES, INC.
CHAIN-OF-CUSTODY FORM

PROJECT NUMBER: 2319	PROJECT NAME: Ames St. /Taylor
LOCATION: 95 Ames Street	CLIENT: ABB
TARGET COMPOUNDS: [redacted]	7 DAYS PER DAN D. 9/3/97 3:35pm

SAMPLE NUMBER	LAB ID No. (for lab use only)	REMARKS Condition of sample or vial	Date	Time	Init.
SGM-1		Little mud on exterior	9/2/97	1900	GK
SGM-2			9/2/97	1900	GK
SGM-3			9/2/97	1900	GK
SGM-4		Cartridge sitting in H2O	9/2/97	1900	GK
SGM-5		" " " "	9/2/97	1900	GK
SGM-6			9/2/97	1900	GK
SGM-7			9/2/97	1900	GK
SGM-8			9/2/97	1900	GK
SGM-9			9/2/97	1900	GK
SGM-10			9/2/97	1900	GK
B			9/2/97	1900	GK
Blank-Trip-2			9/2/97	1900	GK

RELINQUISHED BY		DATE	TIME	RECEIVED BY	
Signature	Printed Name			Signature	Printed Name
	Steve Thornley	8.25.97	1500	Fedex	
Fedex		9/2/97	1900		Geoff Knight
	Geoff Knight	9/2/97	1930	Fed Ex	

9/3/97 Fx ⑤ 10:15am

Attachment D
Summary of Test Trench Sorbent Tube Analyses and Calculations

TABLE D-1
Test Trench Air Sampling Data Summary
Taylor Instruments Facility Site Investigation

SITE_ID	SAMP_ID	ANALYTE	RESULT	UNITS	MDL	MRL	TIME (min)	Q (L/min)	VOLUME (L)	VOLUME (m3)	AIR_CONC (ug/m3)	AIR_CONC (mg/m3)	COMMENTS
TP-1	TPM01NIXX	MERCURY	10.7	ug/Tube	0.075	0.075	40	0.2494	9.976	0.009976	1073	1.073	Test Pit 1 immediately after excavation. Test pit open.
TP-1	TPM01NCXX	MERCURY	796	ug/Tube	0.075	7.5	41	0.2494	10.2254	0.0102254	77845	77.845	Test Pit 1 covered with plastic. One tube on air pump.
TP-1	TPM01NCX1	MERCURY	760	ug/Tube	0.075	7.5	--	--	--	--	--	--	Test Pit 1 covered. First tube in series.
TP-1	TPM01NCX2	MERCURY	2.94	ug/Tube	0.075	0.075	--	--	--	--	--	--	Test Pit 1 covered. Second tube in series.
TP-1	TOTAL		762.94	ug/Tubes			40	0.2498	9.992	0.009992	76355	76.355	Results of both tubes added together. Same measurement as
TP-1	TPM01NUX1	MERCURY	1.97	ug/Tube	0.075	0.075	--	--	--	--	--	--	Test Pit 1 open next day. First tube in series.
TP-1	TPM01NUX2	MERCURY	1.54	ug/Tube	0.075	0.075	--	--	--	--	--	--	Test Pit 1 open next day. Second tube in series.
TP-1	TOTAL		3.51	ug/Tubes			40	0.2498	9.992	0.009992	351	0.351	Results of both tubes.
	QF-1	MERCURY	ND	ug/Tube	0.075	0.075	--	--	--	--	--	--	Field Blank.
	QF-2	MERCURY	ND	ug/Tube	0.075	0.075	--	--	--	--	--	--	Field Blank.
TP-2	TPM02NIX1	MERCURY	1.20	ug/Tube	0.075	0.075	--	--	--	--	--	--	Test Pit 2 just after excavation; 3 feet off floor. First tube in series.
TP-2	TPM02NIX2	MERCURY	ND	ug/Tube	0.075	0.075	--	--	--	--	--	--	Test Pit 2 just after excavation; 3 feet off floor. Second tube in series.
TP-2	TOTAL		1.20	ug/Tubes			120	0.250	30	0.03	40	0.040	Results of both tubes.
TP-2	TPM02NCXX1	MERCURY	2.06	ug/Tube	0.075	0.075	--	--	--	--	--	--	Test Pit 2 covered. Primary sample. First tube in series.
TP-2	TPM02NCXX2	MERCURY	ND	ug/Tube	0.075	0.075	--	--	--	--	--	--	Test Pit 2 covered. Primary sample. Second tube in series.
TP-2	TOTAL		2.06	ug/Tubes			120	0.250	30	0.03	69	0.069	Results of both primary sample tubes.
TP-2	TPM02NCXD1	MERCURY	1.54	ug/Tube	0.075	0.075	--	--	--	--	--	--	Test pit 2 covered. Field duplicate sample. First tube in series.
TP-2	TPM02NCXD2	MERCURY	ND	ug/Tube	0.075	0.075	--	--	--	--	--	--	Test pit 2 covered. Field duplicate sample. Second tube in series.
TP-2	TOTAL		1.54	ug/Tubes			120	0.250	30	0.03	51	0.051	Results of both field duplicate tubes.
TP-2	TMP02NUX1	MERCURY	ND	ug/Tube	0.075	0.075	120	0.250	--	--	--	--	Test pit 2 open next day. First tube in series.
TP-2	TMP02NUX2	MERCURY	ND	ug/Tube	0.075	0.075	120	0.250	--	--	--	--	Test pit 2 open next day. Second tube in series.
	QF-2	MERCURY	ND	ug/Tube	0.075	0.075	--	--	--	--	--	--	Field Blank.
	QM-2	MERCURY	ND	ug/Tube	0.075	0.075	--	--	--	--	--	--	Media blank.
	QM-3	MERCURY	ND	ug/Tube	0.075	0.075	--	--	--	--	--	--	Media blank.
TP-3	TMP03NIX1	MERCURY	ND	ug/Tube	0.075	0.075	120	0.250	--	--	--	--	Test Pit 3 just after excavation. First tube in series.
TP-3	TMP03NIX2	MERCURY	ND	ug/Tube	0.075	0.075	120	0.250	--	--	--	--	Test Pit 3 just after excavation. Second tube in series.
TP-3	TMP03NCX1	MERCURY	ND	ug/Tube	0.075	0.075	45	0.250	--	--	--	--	Test pit 3 covered. First tube in series.
TP-3	TMP03NCX2	MERCURY	ND	ug/Tube	0.075	0.075	45	0.250	--	--	--	--	Test pit 3 covered. Second tube in series.
TP-3	TMP03NUX1	MERCURY	ND	ug/Tube	0.075	0.075	120	0.250	--	--	--	--	Test pit 3 open next day. First tube in series.
TP-3	TMP03NUX2	MERCURY	ND	ug/Tube	0.075	0.075	120	0.250	--	--	--	--	Test pit 3 open next day. Second tube in series.

NOTES:

MDL = method detection limit
MRL = minimum reporting limit
Q = air flow

ACGIH TLV (8-hr TWA) = 0.025 mg/m3. NIOSH REL (8-hr TWA) = 0.05 mg/m3. OSHA ceiling limit = 0.1 mg/m3

Attachment E
Results Summary Table, Soil Sampling

TABLE E-1

Comprehensive Analytical Results - Soil Sampling
Mercury Soil Gas Monitoring and Test Pit Locations
Taylor Instruments Facility Site Investigation

SITE ID	SAMP ID	DEPTH	ANALYTE	RESULT	TAGM RSCO	REPORT LIMIT	UNITS	NOTES
SGM-1	TSM01XX5XX	5	MERCURY	0.189	0.1	0.179	MG/KG	
SGM-2	TSM02XX5XX	5	MERCURY	0.305	0.1	0.169	MG/KG	
SGM-3	TSM03XX5XX	5	MERCURY	17.7	0.1	1.73	MG/KG	
SGM-4	TSM04XX5XX	5	MERCURY	ND	0.1	0.175	MG/KG	
SGM-5	TSM05XX5XX	5	MERCURY	0.241	0.1	0.167	MG/KG	
SGM-6	TSM06XX5XX	5	MERCURY	1.13	0.1	0.182	MG/KG	
SGM-7	TSM07XX5XX	5	MERCURY	0.915	0.1	0.167	MG/KG	
SGM-8	TSM08XX5XX	5	MERCURY	0.673	0.1	0.166	MG/KG	
SGM-9	TSM09XX5XX	5	MERCURY	0.892	0.1	0.163	MG/KG	
SGM-9	TSM09XX5XX	5	MERCURY	0.578	0.1	0.162	MG/KG	
SGM-10	TSM10XX5XX	5	MERCURY	12.0	0.1	0.877	MG/KG	Pit flooded; excavated new SGM-10 for flux measurement
SGM-10	TSM10XX11X	0.5	MERCURY	4.06	0.15	0.832	MG/KG	"New" SGM-10 location
SGM-16	TSM16XX1XX	0.5	MERCURY	95.1	0.15	17.8	MG/KG	
TP-1	PSM0106CX	6	MERCURY	0.832	0.1	0.171	MG/KG	Trench floor
TP-1	PSM0106CE	5	MERCURY	162	0.1	19.3	MG/KG	East sidewall; fill soil
TP-1	PSM0106CN	3	MERCURY	143	0.1	20.5	MG/KG	South (not north) sidewall; fill soil
TP-1	PSM0106CW	4	MERCURY	18.4	0.1	1.90	MG/KG	West sidewall; immediately below fill with glass shards
TP-1	PSM0106CS	5	MERCURY	45300	0.1	1860	MG/KG	North sidewall; fill soil with glass shards
TP-2	PSM0206CX	4	MERCURY	81.7	0.1	17.2	MG/KG	Composite of sidewalls and floor
TP-3	PSM0306CD	4	MERCURY	0.418	0.1	0.174	MG/KG	Composite of sidewalls and floor
TP-3	PSM0306CX	4	MERCURY	0.253	0.1	0.173	MG/KG	Composite of sidewalls and floor