Appendix F

Wipe Sample Data and Discussion

Wipe Sampling Results

Wipe samples were collected from various surfaces to evaluate the deposition of mercury condensate and mercury-contaminated particulates on surfaces inside the containment. A set of wipe samples from nine different locations was collected prior to testing each DTC device (pre-test wipes), and another set was collected near the same nine locations at the conclusion of the test for each device (post-test wipes). Refer to Section 3.3 for wipe sample locations. These analyses were conducted as part of the Mass Balance Study to help quantify the mass of mercury released (i.e., not captured by the DTC device).

The results of the pre-test wipes and the post-test wipes were compared to each other. Pre-test and post-test wipes were collected from approximately the same general locations within the containment, to account for any spatial variation in ambient conditions (e.g., sampling location relative to the crusher, difference in local ventilation patterns).

To review the individual wipe sample results, refer to Appendix A, Table 2.

Wipe Sample Results – PVS Phase I

The wipe sample analytical results from Phase I of the Performance Validation Study (PVS) indicated that baseline mercury concentrations were present inside the AERC Ashland facility prior to initiation of this study. The ranges of results for each device are listed in Table 1 below.

Table 1: Phase I Performance Validation Study Wipe Sample Results

Device	Wipe Sample Results (µg/100 cm^2)	
	Pre-Test	Post-Test
Manufacturer A	0.016 – 0.49	0.013 – 0.19
Manufacturer B	ND – 0.17	ND – 0.64
Manufacturer C	ND – 0.71	0.021 – 3.1
Manufacturer D	0.028 – 0.40	ND – 0.1

Detectable concentrations of mercury were noted on pre-test wipes when testing all four devices. Approximately 44 percent of the total post-test wipes exhibited higher levels of mercury than the pre-test wipes.

Wipe Sample Results – EFT#1

The wipe sample analytical result indicated that baseline mercury concentrations were present during Extended Field Test (EFT) #1 in the EPSI facility. The ranges of results for each device are presented in Table 2.

Table 2: Extended Field Test #1 Wipe Sampling Results

Device	Wipe Sample Results (µg/100 cm²)	
	Pre-Test	Post-Test
Manufacturer A	ND – 9.40	0.058 – 5.0
Manufacturer B	0.088 – 0.800	0.050 – 1.60
Manufacturer C	0.019 – 0.17	0.14 – 2.7
Manufacturer D	0.034 – 5.30	0.038 – 4.5

Detectable concentrations of mercury were noted on pre-test wipes when testing all four devices. Approximately 75 percent of the total post-test wipe results exhibited higher levels of mercury than the pre-test wipes.

Wipe Sample Results – EFT #2

Upon review of the wipe sample results collected during PVS Phase I and EFT #1, it was apparent that the baseline level of mercury contamination already present at the recycling facilities had the potential to confound the study results. One possible source of this contamination was the practice of measuring and cutting the polyethylene sheeting on the (contaminated) work area floor.

The team worked to reduce the interference from this contamination at the AERC Melbourne facility by measuring and cutting the polyethylene outdoors, in the parking lot behind the facility. A clean sheet of polyethylene was first laid on the ground to create an uncontaminated work surface. The polyethylene sheeting for the containment structure was cut and stored outside the facility on the clean, polyethylene work surface.

To further evaluate baseline the high levels of mercury found in pre-test wipes, it was also decided to collect two additional wipe samples inside the containment area the morning after the DTC devices were left idle in the containment overnight. One of the additional wipe samples was taken from the floor approximately two feet away from the device, and the other additional wipe sample was taken from the east wall of the containment. Field personnel attempted to collect these samples from approximately the same location as the earlier wipe samples.

Levels of mercury were still detected on the pre-test wipes collected for all three devices during EFT #2. The ranges of results for each device are presented in Table 3 below.

Table 3: Extended Field Test #2 Wipe Sampling Results

Device	Wipe Sample Results (µg/100 cm²)	
	Pre-Test	Post-Test
Manufacturer A	0.015 – 0.860	0.052 – 3.6
Manufacturer B	0.035 – 0.63	0.050 – 1.60
Manufacturer C	0.08 – 0.25	0.02 – 0.49

Approximately 70 percent of the total post-test wipes exhibited higher detected levels of mercury than the pre-test wipes, which was similar to the EPSI facility.

Wipe Sample Results – EFT #3

As in EFT #2, to reduce the level of mercury contamination on the polyethylene used to construct the containment, the procedure of measuring and cutting the polyethylene sheeting was performed outdoors in the parking lot behind the Ashland AERC Facility. In addition, a separate piece of polyethylene was measured, cut, and placed on the facility floor beneath each prepared containment structure. This task was performed to attempt to further reduce the effects of the ambient level of mercury contamination on test results.

The wipe sample results indicate that there was a level of background contamination present in the AERC Ashland facility during EFT #3. The ranges of results for each device are presented in Table 4 below.

Table 4: Extended Field Test #3 Wipe Sampling Results

Device	Wipe Sample Results (µg/100 cm²)	
	Pre-Test	Post-Test
Manufacturer C	0.020 – 0.17	0.092 – 2.8
Manufacturer B	0.024 – 0.23	0.055 – 3.8
Manufacturer A	ND – 0.73	0.11 – 1.7

All three DTC device studies resulted in the detection of mercury on pre-test wipes. Approximately 89 percent of the total post-test wipes exhibited higher detected levels of mercury than the pre-test wipes.

Wipe Sample Results – PVS Phase II

The ranges of wipe sampling results for each device are presented in Table 5.

Table 5: Phase II Performance Validation Study Wipe Sample Results

Device	Wipe Sample Results (µg/100 cm²)	
	Pre-Test	Post-Test
Manufacturer A	0.011 – 1.7	0.024 – 1.1
Manufacturer B	0.039 – 0.98	0.043 – 0.45
Manufacturer C	0.016 – 0.98	0.019 – 0.43

As during the Phase I test, the wipe sampling results from PVS Phase II indicated a baseline level of airborne mercury present in the AERC Ashland facility, most likely caused by the routine lamp crushing operations. All three DTC device tests resulted in the detection of mercury on pre-test wipes. Only 48 percent of all post-test wipes exhibited higher concentrations of mercury than the pre-test wipes.

Conclusions

Mercury was detected in the pre-test wipes, regardless of testing location. The higher mercury concentrations on pre-test wipes were not anticipated when the sampling and study plan was finalized. These elevated results indicated contamination prior to the operation of the DTC devices. Thorough review of the sampling and study plan by an individual with experience measuring mercury in field conditions would likely have helped the study team avoid or minimize these complications.

The mercury contamination on the polyethylene containment surfaces may have had several different sources. The ambient mercury vapor in the facilities may have deposited/sorbed onto on the polyethylene before the pre-test wipes were collected. Cross-contamination of the polyethylene sheeting may have occurred when it was sized and cut on the warehouse floor of the facility.

As described above, at the AERC Melbourne facility and the AERC Ashland facility (EFT #2, EFT #3, and PVS Phase II), the polyethylene sheeting was measured and cut outside the facility. Even after this methodology was adopted, many of the pre-test wipes were higher than the post-test wipes (during EFT #2, 30 percent were higher; during EFT #3, 11 percent were higher, and during PVS II, 52 percent were higher). This indicates that cutting the polyethylene sheets outdoors, away from the warehouse and on top of another polyethylene sheet, did not significantly decrease mercury contamination during construction of the containment.

In general, the two additional post-test wipes taken the day after testing at the AERC Melbourne facility and the AERC Ashland facility were higher than the corresponding post-test wipes taken the same day that the DTC device was

operated. This indicates that the ambient mercury most likely contributed to the high mercury levels detected for most of the pre-test wipes.

The wipe samples provided inconclusive data due to contamination. The study team determined that the wipe sample results would not be used as part of the Mass Balance Study.