UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

OFFICE OF CHEMICAL SAFETY
AND POLLUTION PREVENTION

MEMORANDUM

Date: March 11, 2011

SUBJECT: Review of Agricultural Handler Exposure Task Force (AHETF) Open Cab Airblast Applicator Exposure Monitoring Studies: AHE62, AHE63, AHE64

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This memorandum presents the Health Effects Division's primary reviews of the analytical and field phase reports for the following Agricultural Handler Exposure Task Force (AHETF) open cab airblast applicator studies: AHE62, AHE63, and AHE64. Details of a previously reviewed open cab airblast study (Smith, L., 2004; EPA Review: Dawson, J., 2006, D316628) is included as well, since these four studies will comprise a complete dataset. The open cab airblast applicator scenario monograph (AHETF, 2010; MRID 48326701) – incorporating these 4 studies into a single dataset and providing statistical analysis for benchmark analytical objectives – is reviewed separately (Crowley, 2011; D387287).

These studies meet EPA standards for occupational pesticide exposure monitoring and are considered acceptable and appropriate for use in occupational exposure assessments for open cab airblast applicators.

1.0 Executive Summary

The Agricultural Handler Exposure Task Force (AHETF) monitored exposure for 28 workers[1] applying liquid spray pesticides using open cab airblast equipment. Four separate field studies, summarized in Table 1 below, were conducted, each monitoring different workers while spraying tree or trellis crops in 5 different states in the U.S where open cab airblast equipment is commonly used in production agriculture.

Table 1. Study Summary

Study ID	State	Crop	No. Monitored Workers	Gender	Ages
AHE07	GA	peach	5	Male	49-56
	ID	apple & pear	6	Male	40-61
	FL	orange	4	Male	33-72
AHE62	CA	grape	3	Male	43-79
AHE63	NY	grape	5	Male	28-66
AHE64	OK	pecan	5	Male	47-59

Monitored on actual days of work, participants handled from 5 to 90 lbs of active ingredient (carbaryl or malathion), spraying 3 to 30 acres in 1.4 to 10.6 hours. Dermal exposure was measured using hand washes, face/neck wipes, whole body dosimeters (100% cotton union suits) for the remainder of the body (torso, arms, and legs), and gauze patches on the inside and outside of chemical-resistant (CR) hats for exposure to the head. Inhalation exposure was measured using personal air sampling pumps and OSHA Versatile Samplers (OVS) mounted on the shirt collar. Results represent dermal exposure with and without chemical-resistant hats while wearing a long-sleeved shirt, pants, shoes/socks, and chemical-resistant gloves, and inhalation exposure without respiratory protection.

All studies followed the applicable and most up-to-date AHETF standard operating procedures (SOPs) and their corresponding protocols with deviations appropriately recorded with none considered to have compromised the overall research. Field and laboratory fortification samples were acceptable, generally averaging between 70 and 120% recovery, with no systematic deviations. All field samples were appropriately adjusted for the corresponding recovery adjustment factors.

Table 2 below summarizes the results, presenting the full range and a simple average of dermal exposure with and without chemical-resistant hats and inhalation exposure without respiratory protection.

Table 2. AHETF Open Cab Airblast Exposure Data Summary

	Dermal Exposure						Inhalation Exposure		
	with CR Hats			w/o CR Hats					
Statistic	µg	µg/kg	µg/lb ai	µg	µg/kg	µg/lb ai	µg	µg/kg	µg/lb ai

[1] Execution of Study AHE07 resulted in 25 total measurements (after accounting for a repeated measure on the same worker, an aborted sample due to equipment failure, and an unanalyzed sample due to a worker switching headgear midday). However, 10 of these workers wore chemical-resistant jackets with hoods and are not included in this scenario since the jacket would constitute a "double layer" and would not meet the AHETF personal protection equipment (PPE) definition for this scenario. Thus, the total of 15 monitored workers for this scenario adopted from AHE07.

Minimum	60.3	0.66	4	69.8	0.81	3.8	0.294	0.003	0.00026
Maximum	80702	877	3202	233089	2534	9355	529	5.34	7.13
Average	7511	86.7	281	35930	425	1227	61.0	0.72	1.71
Note: For dermal exposure for workers wearing chemical-resistant hats, the average contribution of hand rinse and face/neck wipe residues to the total dermal exposure was approximately 30%. Per Agency policy, this triggers a 2X adjustment on hand rinse and face/neck wipe measurements to account for assumed residue collection method inefficiencies. No adjustment was used for dermal exposure values for workers without chemical-resistant hats, as the contribution to total dermal exposure averaged 7%. See Section 3.3.									

2.0 Summary of Field Study Characteristics

This section provides summary characteristics of the five open-cab airblast exposure studies. Attached supplemental tables (Tables S1-8) containing supporting details are cited in each subsection.

2.1 Administrative Summary (Table S – 1)

All studies were sponsored by the AHETF and followed both the study-specific protocols and the AHETF Governing Document (AHETF, 2008-a). Additionally, they were in substantial compliance with Good Laboratory Practice Standards (GLPS) (40 CFR §160)[2] and met EPA Test Guidelines in Series 875 – Occupational and Residential Exposure (875.1100 – dermal exposure; 875.1300 – inhalation exposure). Signed copies of acceptable Quality Assurance and Data Confidentiality statements were provided for each study.

2.2 Test Materials (Table S – 2)

All studies used liquid formulation pesticides containing carbaryl or malathion.

2.3 Sample Size, Monitored Workers, and Locations (Table S – 3)

According to the AHETF Governing Document (AHETF, 2008-a) and the Open Cab Airblast Scenario Construction Plan (AHETF, 2008-b), an additional 15 monitored workers (in a "5 workers x 3 site" configuration) combined with the 15 existing monitored workers from AHE07 were considered adequate to complete the open cab airblast application exposure scenario. That is, a total of 30 "monitoring units" (MU), obtained via monitoring exposure from 6 spatially distinct study locations across the U.S. would likely to satisfy pre-defined accuracy benchmarks. However, due to recruitment problems in AHE62 (CA-grape) – where only 3 workers were able to be monitored[3] – the total sample was 28 workers. The locations and crops monitored were: Georgia pecans (6 workers), Idaho apples and pears (5 workers), Florida oranges (4 workers), New York grapes (5 workers), California grapes (3 workers), and Oklahoma pecans (5 workers).

[2] Minor GLPS deviations were noted for all studies, including: test substance was not characterized before use; scales used to weigh subjects and weather monitoring devices were not maintained and calibrated according to GLPS specifications. These deviations do not have any substantive impact on the study results.

[3] A total of only 4 grape growers were found eligible to participate in study AHE62 (CA-grape). Only 3 workers were ultimately monitored because the 4th grower sprayed a different pesticide than the surrogate for this study (malathion).

While AHE07 (GA-pecan, ID-apple/pear, and FL-orange) actually monitored a total of 25 workers, only 15 were selected to populate the open cab airblast scenario because 10 workers wore chemical-resistant hooded jackets – a PPE-level (i.e., a second protective layer provided by the jacket) the AHETF considered outside the definition of the open cab airblast scenario.

2.4 Environmental Conditions (Table S – 4)

Temperature, humidity, wind speed and direction, cloud cover, and rainfall were all reported. The maximum reported temperature was 87° F (AHE62 – CA-grape) and the lowest reported temperature was 33° F (AHE07 – ID-apple/pear). Heat index values were not directly reported in the study report, but provided separately to the Agency. The maximum reported heat index value was 95° F (AHE62 – CA-grape). In no case did the heat index exceed the pre-defined threshold of concern for potential heat-related injury. No significant rainfall was reported.

2.5 Clothing and Personal Protective Equipment (PPE) (Table S – 5)

Per the stated goals of the AHETF, monitoring of open cab airblast applicators was conducted to represent exposure for workers wearing long-sleeve shirts, pants, shoes/socks, chemical-resistant gloves, with or without chemical-resistant hats, and no respiratory protection. So long as the work clothing met the standards of the EPA Worker Protection Standard (WPS), monitoring was conducted with the clothing worn by the worker on the scheduled monitoring day. In two instances – MU 3 and MU 12 in study AHE07 (ID-apple/pear) – the AHETF supplied replacement garments. Per protocol, new chemical-resistant gloves were supplied by the AHETF to all workers at the beginning of the day and were available throughout the day according to WPS requirements. Additionally, some workers, of their own accord, wore protective eyewear, and others wore half-face respirators. In these cases, the exposure measurements were adjusted (according to AHETF SOP 9.K) to extrapolate deposited residue to those portions of the face/head covered by the eyewear or the respirator (see Section 3.3.3).

2.6 Application Characteristics (Table S – 6)

For these studies, only the airblast application activity was monitored – monitoring was not conducted for those workers responsible for mixing and loading the pesticide. The applications were made by trucks or tractors with open cabs hauling airblast sprayers[4]. Rigs were inspected by the study director to ensure compliance with EPA WPS requirements. Application characteristics including crop height and row spacing, truck/tractor and airblast sprayer brands and models, nozzle characteristics, and driving speed are also reported in Table S-6.

2.7 Application Rates (Table S – 7)

Per the AHETF Governing Document (AHETF, 2008-a) and the OCAB Scenario Construction Plan (AHETF, 2008-b), the total amount of active ingredient applied should be diversified across the scenario and within each study to provide adequate analytical power for certain statistical procedures. Specifically, amounts of active ingredient handled within a study should be

[4] Six of the 28 workers drove open cab vehicles with a canopy (see Table S-6). However, the presence of a roof does not appear to reduce exposure. Section 3.4.1 provides more details.

separated logarithmically for each MU and span at least an order of magnitude. Because AHE07 was completed before initiation of this sampling strategy modification, the span of amounts of active ingredient handled does not meet this standard. Table 3 below presents the amount handled for each worker (total amount handled ranged from 5 to 90 lb active ingredient). For AHE62, 63, and 64, which were subject to this strategy, the amount handled was slightly out of the range in three instances (indicated by italics).

Table 3. Summary of Amount Handled (lbs ai)

Desired Stratum of Amount Handled (lbs ai)	Actual Amount Handled (lbs ai) & MU ID (#)					
	AHE07			AHE62 (CA-grape)	AHE63 (NY-grape)	AHE64 (OK-pecan)
	(GA-peach)	(ID-apple/pear)	(FL-orange)			
5-9	--	--	--	5 (A2)	6.1 (A5)	*10.1 (A2)*
10-17	--	--	--	10.4 (A3)	15.2 (A4)	*18.2 (A5)*
18-30	24 (15)	--	--	--	24.4 (A3)	25.2 (A4)
31-55	45 (3) 52 (8)	32 (10) 33 (12) 34 (17) 36 (13) 40 (16)	--	34.3 (A1)	35.6 (A2)	35.3 (A3)
56-100	60 (6) 75 (1) 75 (4)	--	60 (22) 90 (23) 90 (26) 90 (27)	--	*48.4 (A1)*	63.1 (A1)

In order to help achieve the range of amount of active ingredient handled as well as to avoid non-detectable exposures, the study design called for workers to apply at least 3 tank loads and/or work for at least 4 hours per day. In a few cases, work days were less than 4 hours (monitoring durations ranged from 1.4-10.6 hours); however these instances did not result in failure to capture the desired amount of active ingredient handled or non-detectable exposures.

2.8 Exposure Monitoring and Analytical Methods (Table S – 8)

Passive dosimetry methods were utilized for all monitoring – no biomonitoring samples were collected. Dermal exposure to the hands was measured using a hand rinse method administered at the end of the workday as well as at lunch, restroom breaks, or other instances where workers would otherwise wash their hands as outlined in AHETF SOP 8.B. Dermal exposure to the face/neck was measured using a wipe technique as outlined in AHETF SOP 8.C and extrapolated to non-wiped portions of the head (i.e., those parts covered by goggles or a respirator or covered by hair) according to AHETF SOP 9.K. Exposure to the head inside and outside of chemical-resistant hats was measured using 50 and 100 cm^2 gauze patches, respectively, which were then used to extrapolate to the whole head based on the surface area of the patch and the surface area of the head. Dermal exposure to the remainder of the body (torso, arms, legs) was measured using whole body dosimeters (100% cotton union suits), analyzed as 6 separate sections: upper arm, lower arm, front torso, rear torso, upper leg and lower leg, per according to AHETF SOP 8.A. Additionally, in AHE07, exposure to the feet was measured using cotton socks; however this method was not utilized in AHE62-64 due to the relatively small contribution to exposure seen in AHE07. All these measurements combine to reflect dermal exposure underneath a single layer of work clothing (long-sleeve shirt, pants, shoes/socks), chemical-resistant gloves, and with

or without a chemical-resistant hat. Inhalation exposure was measured using OVS tubes mounted on the worker's collar and personal sampling pumps (set at 2 liters per minute) according to AHETF SOP 8.D. The concentrations measured represent the chemical available in each worker's breathing zone.

Validated analytical methods specific to each type of monitoring matrix were used to extract residues followed by quantification with gas chromatography (GC) employing flame photometric detection in phosphorous mode (FPD/P). Modifications to analytical methods are outlined in the submitted analytical reports. Limits of quantification and detection (as defined in AHETF SOP 9.A) are presented in Table 4 below.

Table 4. Analytical Limits (ug/sample) for AHE07 and AHE62-64

Monitoring Matrix			Limit of Detection		Limit of Quantification	
			Carbaryl	Malathion	Carbaryl	Malathion
Inner Dosimeter	AHE07		--	NA	0.25	NA
	AHE62-64		0.3	0.3	1.0	1.0
Hand Rinse	AHE07		--	NA	1.0	NA
	AHE62-64		0.3	0.3	1.0	1.0
Face/Neck Wipe	AHE07		--	NA	1.0	NA
	AHE62-64		0.3	0.3	1.0	1.0
Socks (AHE07 only)			--	NA	0.25	NA
Head patches	AHE07		--	NA	0.25	NA
	AHE62-64		0.075	0.075	0.25	0.25
OVS air sampler	AHE07	GA & ID	--	NA	0.01	NA
		FL	--	NA	0.05	NA
	AHE62-64		0.0015	0.0015	0.005	0.005

Note: no LOD was derived in AHE07 for any matrix.
NA = not applicable, chemical not used.

3.0 Results

This section provides a discussion of quality assurance and quality control sampling and the actual field monitoring measurements of workers. Corresponding supplemental tables providing additional detail are identified.

3.1 Quality Assurance

All phases of each study were subject to appropriate quality assurance processes according to EPA's GLPs and inspected/audited by the AHETF Quality Assurance Unit (QAU) per AHETF SOPs (AHETF SOP Chapter 5: A-K). The inspected phases were: Protocol, Field Phase, Field Data, Draft Report, Analytical Data, Final Report, and Post-Audit Report. Each study contains a signed quality assurance compliance statement as required by GLPs. Protocol amendments or deviations were addressed appropriately under GLP guidance and are described further in Section 4.0.

3.2 Quality Control

AHETF instituted various quality control measures to ensure proper field conduct including calibration of sprayers, preparation and handling of exposure measurement matrices, evaluation

of test material, and field observations (AHETF SOP Chapter 10: A-G). Analytical quality control measures for ensuring the integrity of measurements captured in the research were also instituted according to AHETF SOP 9.J. Exposure monitoring matrices (inner whole body dosimeters, hand washes, face/neck wipes, OVS tubes) were fortified with known amounts of active ingredient to assess their stability during field, transit, and storage conditions according to AHETF SOP 8.E. Laboratory control samples were also fortified at the level of quantification and at levels capturing the range of expected field exposures for each matrix. Generally, field fortification samples were collected in triplicate at each of 3 levels (high, middle, and low) on each sampling day. Travel fortifications were generally conducted on each day of sampling in duplicate at the high fortification level only. Untreated control samples were generally conducted in duplicate on each day of sampling. Deviations from this general sampling protocol are specified in the sub-sections below.

The following sections provide results for all quality control sampling across all exposure measurement matrices for all chemicals used. The identified supplemental tables should be referenced for chemical-specific results.

3.2.1 Control Samples (Table S – 9)

As expected, most non-fortified (blank) laboratory and field control samples were below the LOQ. For AHE62-64, in no instance was an untreated laboratory control found to contain residues. However, for AHE07, residues were detected in untreated laboratory control samples for 5 of 25 inner dosimeter samples, all (9 of 9) OVS samples, and 1 of 9 sock samples. Potential reasons for these findings were not addressed, nor were any corrections made to samples based on these results.

For control samples in the fields, most had non-detectable residues, as would be expected. However, particularly for the OVS air sampler field controls, there were some found to have detectable residues. No summary of these results was provided in the study report. Detected residues in field control samples is a potentially notable finding, since they may impact field fortification recovery estimates, which in turn could alter actual field sample measurements. Despite the findings in these studies, no action is deemed necessary because only trace amounts were found (most samples were below the LOQ, with some only slightly above the LOQ) which do not significantly impact the results. However, for future AHETF studies, residues found in field control or laboratory control samples should be systematically summarized and reasons for accounting for them (or not) should be described in the study reports.

3.2.2 Laboratory Fortification Recoveries (Table S – 10)

Along with one untreated control, two fortified samples served as additional laboratory recovery samples – one at the LOQ and the other at a level designated to encompass the range of anticipated residues. Average recoveries for each sampling media were > 90% thus no corrections were made to the field sampling measurements based on this aspect of the analytical process.

3.2.3 Field Fortification Recoveries

Field fortification sampling matrices are spiked with known amounts of chemical, then placed in the exposure monitoring area under similar conditions as those in which the actual sampling matrices used on the workers are handled (including drawing air through OVS samplers). Additional samples are fortified to assess degradation of the sample during transit from the field to the lab, but, per AHETF protocol, only analyzed if anomalous field fortification recoveries indicate potential degradation during transport. No storage or transport fortification samples were analyzed.

Field fortifications are conducted at 3 levels (except for the inner and outer head patches which are fortified at 2 levels) to capture the expected range of results, with triplicate samples taken on each day at each fortification level[5]. Once analyzed, the average recovery results (expressed as a percentage of known amount applied) are used as multipliers to adjust, or correct, all measured field samples. As the fortification samples are conducted at levels to capture the range of expected field sample results, adjustments are done using the average percent recovery for the fortification level closest to the measured field sample. The mid-point between each fortification level is used as the threshold in determining the average recovery percentage to adjust the field sample.

With few exceptions, field fortification averages for each fortification level and each monitoring matrix were in the range of 70-120%. A summary of field fortification results for each matrix is provided below in Sections 3.2.3.1 – 3.2.3.4.

3.2.3.1 Inner Dosimeters (Table S – 11a and Table S – 11b)

Most results for inner whole body dosimeter (WBD) field fortification samples were acceptable, with recoveries ranging from 75% to 110%. Unusually low recoveries were observed at the 5 ug fortification level on the first day of sampling in AHE62 (43%, 37% and 32%). Additionally, fortification samples on the first day of sampling in AHE63 were not used to calculate average recoveries as abnormally high and low recoveries were observed at all fortification levels.

3.2.3.2 Face/Neck Wipes (Table S – 12a and Table S – 12b)

Results for face/neck wipe field fortification samples were acceptable, with average recoveries ranging from approximately 84.7% to 106%.

3.2.3.3 Hand Washes (Table S – 13a and Table S – 13b)

Results for hand wash field fortification samples were acceptable, with average recoveries ranging from 93.3% to 113%.

3.2.3.4 OVS Air Samplers (Table S – 14a and Table S – 14b)

[5] As it was conducted a few years prior to current AHETF protocols, AHE07 had a slightly different strategy for fortification sampling: 4 fortification levels for inner dosimeters and 2 fortification levels for the face/neck wipes, hand washes, head patches, socks, and OVS tubes.

The results for OVS field fortification samples were acceptable, with average recoveries ranging from approximately 99% to 122%. Unusually high recovery results were observed at fortification levels on the second day of sampling in AHE62 (low level: 2014%, 570%, and 1103%; mid-level: 195%, 171%, 192% – contamination suspected) and the results were not used in calculating average recoveries. Additionally, per AHETF standard procedures, samples for the highest fortification level (1000 ug) went unanalyzed as no OVS air sample in the field exceeded 100 ug.

3.2.3.5 Head Patches

3.2.3.5.1 Outer Patches (Table S – 15)

The results for outer head patch samples were acceptable, with average recoveries ranging from approximately 54% to 122%. Abnormally low recoveries were observed at the 5 ug fortification level on the second day of sampling in AHE63 (54.8%, 59.5%, and 61.6%).

3.2.3.5.2 Inner Patches (Table S – 16a and Table S – 16b)

The results for outer head patch samples were acceptable, with average recoveries ranging from approximately 52.4% to 109%, though abnormally low recoveries (< 70%) were observed for most of the samples in AHE63.

3.2.3.6 Socks (Table S – 17)

The results for field fortification of sock matrices (in AHE07 only) samples were acceptable, with average recoveries ranging from approximately 69% to 93%. Some abnormally low results were observed at the low fortification level (5 ug): the third through the sixth sampling day ranged from 48%-71%.

3.3 Field Measurements

The following sections summarize the exposure monitoring results, conducted as described in Section 2.8. All measurements were appropriately adjusted for field fortification recoveries. Face/neck wipe measurements reflect extrapolation to un-wiped portions of the face covered by protective eyewear or a respirator according to AHETF SOP 9.K. For samples below the LOQ or LOD, ½ LOQ or ½ LOD was used.

Additionally, in order to account for potential residue collection method inefficiencies per EPA policy, the AHETF has made adjustments to hand and face/neck field study measurements as follows[6]:

[6] This directive was discussed and presented at a meeting of the Human Studies Review Board (June 2007). The terminology used to describe this are "method efficiency adjusted" (MEA) or "method efficiency corrected" (MEC). For this scenario, adjustments are made to face/neck wipe and hand wash measurements for exposures to workers while wearing chemical-resistant hats only. For exposures without chemical-resistant hats, because the contribution to total dermal exposure by the face/neck and hands is less than 20%, adjustments are unnecessary.

- if measured exposures from hands, face and neck contribute less than 20% as an average across all workers, no action is required;
- if measured exposure contribution from hands and face/neck represents between 20% and 60% of total, the measurements shall be adjusted upward by 50%, or submission of a validation study to support the residue collection method
- if measured exposure contribution from hands and face/neck represents is greater than 60%, a validation study demonstrating the efficiency of the residue collection methods is required.

3.3.1 Inner Dosimeters (Table S – 18a, Table S – 18b, and Table S – 18c)

Inner whole body dosimeters were sectioned and analyzed separately in six sections. Out of a total of 158 inner dosimeter sample sections, only 5 were below the LOQ or LOD (all 5 were from AHE64). After adjusting for field fortification recoveries (see Section 3.2.3.1), the ranges for each body part were as follows:

- Lower arms: 2.0 – 5631 µg
- Upper arms: 0.5 – 2888 µg
- Front torso: 0.5 – 3559 µg
- Rear torso: 0.5 – 5492 µg
- Lower leg: 0.5 – 7080 µg
- Upper leg: 0.5 – 50638 µg

3.3.2 Head Patches (Table S – 19)

Gauze patches were placed inside and outside chemical-resistant hats to evaluate exposure to the head with the hats. Out of a total of 28 inner head patch values, 6 were below the LOQ or LOD. All outer head patches contained quantifiable residues. After adjusting for field fortification recoveries (see Section 3.2.3.5), the ranges for each body part were as follows:

- Outer head patches: 0.73 – 13,080 µg
- Inner head patches: 0.04 – 58.1 µg

3.3.3 Face/Neck Wipes (Table S – 20)

Because some workers wore protective eyewear or a respirator, extrapolations from those portions of the face/neck that are wiped need to be made to portions of the head that are not measured. Specifics on these adjustment factors can be found in AHETF SOP 9.K. Additionally, to account for potential inefficiencies in residue collection by the wipe technique, the measurements are further adjusted by a factor of 2 (i.e., assuming 50% inefficiency).

After adjusting for field fortification recoveries (see Section 3.2.3.2) and extrapolating to non-wiped portions of the head described above, face/neck exposure ranged from 3.3 – 3417 µg. Including adjustments for potential method collection inefficiencies (i.e., doubling the measurements), total head exposure ranged from 6.6 – 6834 µg. All face/neck wipe field samples had quantifiable residues.

3.3.4 Hand Washes (Table S – 21)

Per protocol, hand washes were collected at the end of each work day and during restroom or lunch breaks. Only two hand washes were collected from each worker in AHE62-64, while in AHE07 two workers had 4 washes and another 4 workers had 3 washes. As for the face/neck wipe measurements, the hand wash measurements were also increased by a factor of 2 to reflect potential inefficiencies in the collection method.

After adjusting for field fortification recoveries (see Section 3.2.3.3) and summing each hand wash, the total hand exposure ranged from 0.5 – 4146 µg. Including adjustments for potential method collection inefficiencies, total hand exposure ranged from 1.0 – 8292 µg (i.e., doubling the measurements). Out of a total of 54 hand wash samples, only 1 was below the LOQ or LOD.

3.3.5 Socks (Table S – 22)

In AHE07, the AHETF used sock dosimeters to measure exposure to workers' feet. After adjusting for field fortification recoveries (see Section 3.2.3.6), feet exposure ranged from 0.39 – 108 µg. All sock samples had quantifiable residues. Because it was found that in AHE07 feet exposure contributed less 1% to the total dermal exposure for all workers[7], the AHETF did not monitor exposure to the feet in AHE62-64.

3.3.6 OVS Air Samplers (Table S – 25)

Front and back sections of the OVS tube were analyzed separately for AHE62-64, with all but one back section sample was less than the LOQ or LOD and all front section samples having quantifiable residues. After adjusting for field fortification recoveries (see Section 3.2.3.4) the total (front section + back section) collected chemical amounts ranged from 0.07 – 28.7 µg.

3.4 Exposure Calculations (Tables S – 23 to S – 26)

This section provides total exposures (expressed as mass active ingredient), as well as exposures normalized to (i.e., dividing by) body weight and amount of active ingredient handled (AaiH).

3.4.1 Dermal Exposures[8]

Total dermal exposure is calculated by summing the results for inner dosimeters, hand washes, face/neck wipes, and head patches. Note that both the face/neck wipes and head patches are extrapolated using surface area adjustments to non-measured portions of the head. Additionally,

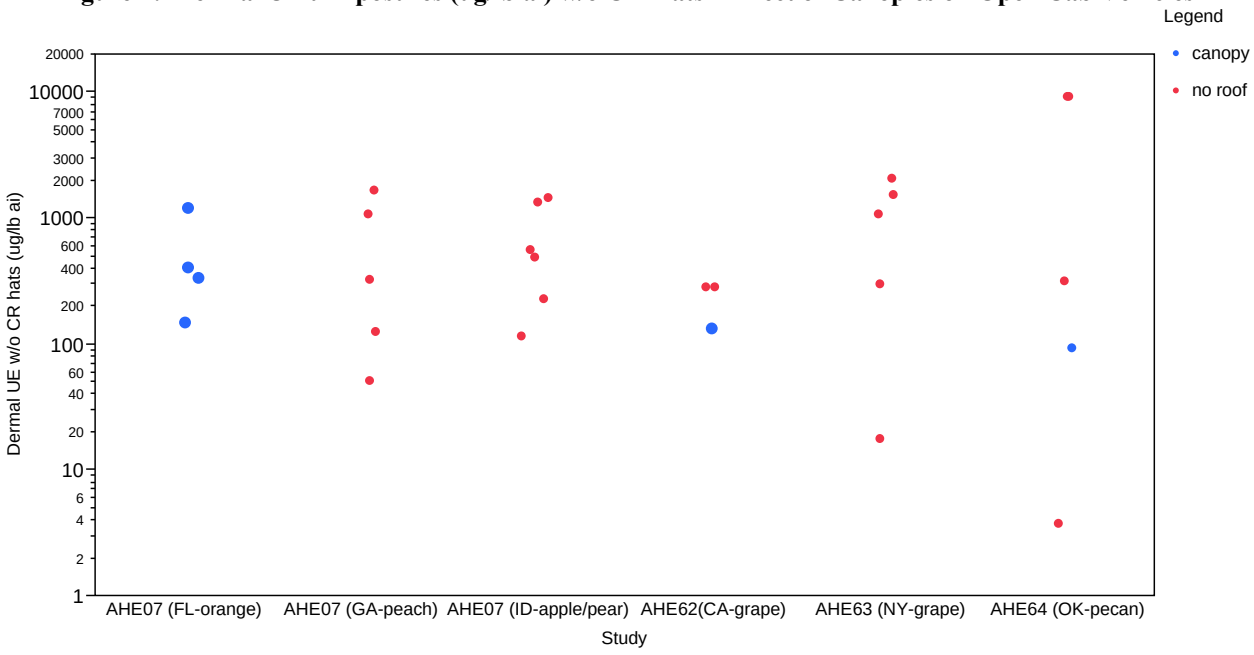
[7] Calculated as a percentage of dermal exposure with chemical-resistant hats. The contribution would be even less when compared with dermal exposure without chemical-resistant hats.

[8] Dermal exposures reflect the 50% method efficiency assumption (i.e., a 2X upward adjustment) for hand rinse and face/neck wipe measurements ("MEA" = method efficiency adjustment) for exposures with chemical-resistant hats only. As previously stated, it is unnecessary to adjust these measurements for dermal exposures without chemical-resistant hats.

the inner and outer head patches provide the ability to express dermal exposures for workers with and without chemical resistant hats.

As outlined in Table S-6, six of the 28 monitored workers used an open cab vehicle that also had a canopy or roof. Figure 1 below presents dermal unit exposures without CR hats for each study and indicates the 6 monitored workers that used an open cab vehicle with a canopy. It does not appear that the presence of a canopy above the workers offers any additional dermal protection. Thus, no differentiation with respect to using the data needs to be made. This was first addressed in the study review for AHE07 (D316628) and can be referenced for additional detail.

Figure 1: Dermal Unit Exposures (ug/lb ai) w/o CR Hats - Effect of Canopies on Open Cab Vehicles



Dermal exposures with chemical-resistant hats ranged from 60.3 – 80,702 µg. Normalized to each worker's body weight, dermal exposures ranged from 0.66 – 877 µg/kg. Normalized by the amount of active ingredient handled, dermal "unit exposures" ranged from 4 – 3,202 µg/lb ai.

Dermal exposures without chemical-resistant hats ranged from 69.8 – 233,089 µg. Normalized to each worker's body weight, dermal exposures ranged from 0.81 – 2,534 µg/kg. Normalized by the amount of active ingredient handled, dermal "unit exposures" ranged from 3.8 – 9,355 µg/lb ai.

3.4.2 Inhalation Exposures

To calculate worker inhalation exposure – specifically, "breathing zone" exposure – the measured amounts are adjusted based on the pump flow rate (in liters per minute) and a typical worker's breathing rate for this type of activity. For these studies a breathing rate of 8.3 liters per minute was used, representing sedentary activities, like driving a tractor (NAFTA, 1998). The calculation is as follows:

*Inhalation exposure = Adjusted residue (µg) * [Breathing rate (LPM) ÷ Pump flow rate (LPM)]*

Calculated inhalation exposures ranged from 0.294 – 529 µg. Normalized to the worker's body weight, inhalation exposures ranged from 0.003 – 5.34 µg/kg. Normalized by the amount of active ingredient handled, inhalation unit exposures ranged from 0.00026 – 7.13 µg/lb ai.

Worker ID A5 in study AHE64 (OK-pecan) has significantly less exposure than the other workers in AHE64 as well as the workers in the other open cab airblast studies. Consideration should be given during further analysis of this data whether it should be treated as an outlier and potentially excluded from the data.

3.5 Field Observations

For all studies, observers were employed to monitor each worker and record their behavior throughout the work day. Much of the observations detailed application procedures (e.g., AHE62 MU A3 @ 1101: "Sprays between final two rows on East end of lower block, 3-point turn to come down end row with left side only spraying."), while others indicated potential impacts on exposure such as spray drift (e.g., AHE63 MUA4 @ 1130: "Spray appears to slightly drift back towards the tractor). Field observations should be considered when analyzing this data.

4.0 Protocol Amendments and Deviations (Table S – 27)

Field and analytical phase deviations were minor. Reported field phase deviations included errors in measuring field fortification recovery levels and slight deviations from specified ranges of amount of active ingredient handled and monitoring time requirements. Analytical phase deviations included instances analytical method modifications and failure to verify field fortification concentrations. No protocol amendments or deviations were considered to adversely affect the results of exposure monitoring or compromise the overall research.

5.0 Conclusion

As the studies followed their corresponding protocols as well as EPA guidelines for occupational pesticide exposure monitoring, the results are considered useful for assessment of exposure and risk for open cab airblast applicators. Since these were collected with the intention to populate a generic pesticide exposure database, reviewers are directed to the additional information and statistical analyses in the AHETF Open Cab Airblast Scenario Monograph (AHETF, 2010; MRID 48326701) and recommendations for use of the data in its corresponding HED review (Crowley, 2011; D387287).

6.0 References

AHETF, (2008-a). Volume IV AHETF Revised Governing Document for a Multi-Year Pesticide Handler Worker Exposure Monitoring Program. Version Number: 1. April 7, 2008. Agricultural Handlers Exposure Task Force (AHETF). [MRID 47172401]

AHETF, (2008-b). Monitoring Unit Selection and Construction Plan for Scenario: Airblast Application of Liquids Sprays to Crops Using Open Cab Equipment. July 21, 2008. Agricultural Handlers Exposure Task Force (AHETF).

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Bruce, E. (2010-a). Determination of Dermal and Inhalation Exposure to Workers During Airblast Applications of Liquid Sprays Using Open Cab Equipment in California Trellis Crops. Study Number AHE62. Unpublished study prepared by the Agricultural Handlers Exposure Task Force. 283 p. November 3, 2010. MRID 48289611.

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Dawson, J., 2006. Memorandom: Carbaryl: Data Evaluation Record For MRID 464482-01; *Determination of Dermal and Inhalation Exposure to Workers during Application of a Liquid Pesticide Product by Open Cab Airblast Application to Orchard Crops*; PC Code 056801; DP Barcode 316628.

NAFTA - Dept. of Pesticide Regulation (DPR), California EPA, HSM-98014, April 24, 1998.

Smith, L. (2010-a). Amended Report – Determination of Dermal and Inhalation Exposure to Workers During Application of a Liquid Pesticide Product by Open Cab Airblast Application to Orchard Crops. Study Number AHE07. Unpublished study prepared by the Agricultural Handlers Exposure Task Force. 235 p. August 23, 2005 (Initial Report Date: December 30, 2004). MRID 46448201.

Smith, L. (2010-b). Determination of Dermal and Inhalation Exposure to Workers During Airblast Applications of Liquid Sprays Using Open Cab Equipment in New York Trellis Crops. Study Number AHE63. Unpublished study prepared by the Agricultural Handlers Exposure Task Force. 245 p. November 3, 2010. MRID 48289612.

Smith, L. (2010-c). Determination of Dermal and Inhalation Exposure to Workers During Airblast Applications of Liquid Sprays Using Open Cab Equipment in Oklahoma Tree Nuts. Study Number AHE64. Unpublished study prepared by the Agricultural Handlers Exposure Task Force. 236 p. November 3, 2010. MRID 48289613.

Supplemental Tables S – 1-28

Table S - 1. Administrative Details						
Study ID		Title	Author	Report Date	Field Principal Investigator	Analytical Facility
AHE#	EPA MRID					
AHE07	46448201	Determination of Dermal and Inhalation Exposure to Workers During Airblast Applications of a Liquid Pesticide Product by Open Cab Airblast Application to Orchard Crops	Larry D. Smith, Ph.D.	12/30/04	Tami Belcher	Morse Laboratories, Inc. 1525 Fulton Ave. Sacramento, CA 95825
AHE62	48289611	Determination of Dermal and Inhalation Exposure to Workers During Airblast Applications of Liquid Sprays Using Open Cab Equipment in California Trellis Crops	Eric Bruce	11/3/10	Brian D. Lange	Morse Laboratories, Inc. 1525 Fulton Ave. Sacramento, CA 95825
AHE63	48289612	Determination of Dermal and Inhalation Exposure to Workers During Airblast Applications of Liquid Sprays Using Open Cab Equipment in New York Trellis Crops	Larry D. Smith, Ph.D.	11/3/10	Aaron Rotondaro	Morse Laboratories, Inc. 1525 Fulton Ave. Sacramento, CA 95825
AHE64	48289613	Determination of Dermal and Inhalation Exposure to Workers During Airblast Applications of Liquid Sprays Using Open Cab Equipment in Oklahoma Tree Nuts	Larry D. Smith, Ph.D.	11/3/10	Aaron Rotondaro	Morse Laboratories, Inc. 1525 Fulton Ave. Sacramento, CA 95825

Table S - 2. Summary of Pesticides Used									
Study ID	Product Information						Product Purity Analysis		
	Trade Name	Formulation	Manufacturer	Packaging	Active Ingredient	Label % ai	Actual % ai	Lot / Batch #	Laboratory (Date)
AHE07	Sevin® XLR Plus	Suspension concentrate	Bayer CropScience	2.5 gallon plastic jug	Carbaryl	44.1% by weight	44.15% by weight	60702302	Morse Laboratories (date unknown)
AHE62	Gowan Malathion 8	Emulsifiable concentrate	Gowan Company	2.5 gallon plastic jug	Malathion	79.5% by weight	68.35% by weight	30AK7005	EPL Bio-Analytical Services (4/20/09)
	Gowan Malathion 8 Flowable	Emulsifiable concentrate	Gowan Company	2.5 gallon plastic jug	Malathion	79.5% by weight	65.70% by weight	30AK8003	EPL Bio-Analytical Services (4/20/09)
	Gowan Malathion 8 Flowable	Emulsifiable concentrate	Gowan Company	2.5 gallon plastic jug	Malathion	79.5% by weight	67.26% by weight	30AK9003	EPL Bio-Analytical Services (4/20/09)
AHE63	Sevin® XLR Plus	Aqueous suspension / flowable	Bayer CropScience	2.5 gallon plastic jug	Carbaryl	44.1% by weight	44.8% by weight	E180426-JH312	EPL Bio-Analytical Services (1/23/09)
AHE64	Sevin® XLR Plus	Aqueous suspension / flowable	Bayer CropScience	2.5 gallon plastic jug	Carbaryl	44.1% by weight	44.5% by weight	K492074-JI148	EPL Bio-Analytical Services (1/23/09)

Table S - 3. Summary of Monitored Workers and Locations											
Study ID	**MU ID**	**Age**	**Gender**	**Height (in)**	**Weight (kg)**	**Yrs. Experience**	**State**	**County**	**Town**	**Date**	**Crop**
AHE07	1	50	M	66	51	19	GA	Brooks	Morven	10/07/03	peach
	3	53	M	69.2	73	2	GA	Brooks	Morven	10/08/03	peach
	4	55	M	72	118	3	GA	Brooks	Morven	10/08/03	peach
	6	49	M	70	68	2	GA	Brooks	Morven	10/09/03	peach
	8	56	M	71.2	64	15	GA	Brooks	Morven	10/09/03	peach
	10	55	M	71.2	94	15	ID	Payette	Payette	10/22/03	apple
	12	61	M	73.2	93	20	ID	Payette	Payette	10/24/03	apple
	13	40	M	71.2	77	20	ID	Payette	Payette	10/24/03	apple
	15	55	M	68	67	35	ID	Payette	Payette	10/24/03	apple
	16	60	M	72	109	40	ID	Payette	Payette	10/25/03	apple
	17	48	M	73.2	89	30	ID	Payette	Fruitland	10/25/03	apple & pear
	22	65	M	69.2	96	30	FL	Polk	Winter Haven	12/10/03	orange
	23	33	M	71.2	127	12	FL	Polk	Winter Haven	12/10/03	orange
	26	72	M	72	77	35	FL	Polk	Winter Haven	12/11/03	orange
	27	47	M	72	99	25	FL	Polk	Winter Haven	12/11/03	orange
AHE62	A1	43	M	66	73	15	CA	Fresno	Firebaugh	07/02/09	grape
	A2	53	M	71	83	8	CA	San Joaquin	Lodi	07/20/09	grape
	A3	79	M	69	89	30	CA	El Dorado	Camino	07/24/09	grape
	A4	AHETF planned to monitor 5 workers in this study, but only 3 were able to be recruited and monitored.									
	A5										
AHE63	A1	52	M	68	114	30	NY	Chautauqua	Not reported	7/28/2009	grape
	A2	66	M	68	79	39	NY	Chautauqua	Not reported	7/30/2009	grape
	A3	45	M	71	83	24	NY	Chautauqua	Not reported	8/3/2009	grape
	A4	58	M	70	93	20	NY	Chautauqua	Not reported	8/5/2009	grape
	A5	28	M	69	89	4	NY	Chautauqua	Not reported	8/6/2009	grape
AHE64	A1	59	M	67	90	10	OK	Okmulgee	Not reported	8/22/2009	pecan
	A2	74	M	71	75	26	OK	Okfuskee	Not reported	8/24/2009	pecan
	A3	47	M	73	96	30	OK	Osage	Not reported	8/25/2009	pecan
	A4	69	M	70	92	3	OK	Rogers	Not reported	8/28/2009	pecan
	A5	67	M	68	86	40	OK	Rogers	Not reported	8/29/2009	pecan

Table S - 4. Summary of Meteorological Conditions

Study ID	State	MU ID	Date	Monitoring Period	Humidity (%)		Temp. (° F)		Wind			Cloud Cover (%)	Heat Index[a]	Rainfall (in)
									Speed (mph)		Direction			
					Max	Min	Max	Min	Max	Min				
AHE07	GA	1	10/07/03	0954-1522	95.9	68.4	79.2	68.8	2.5	0.3	NE	varied	NR	0.1
		3	10/08/03	0928-1606	97.3	62.1	82.6	66.0	1.6	0.7	E	varied	NR	0.1
		4	10/08/03	0907-1455	97.3	62.1	82.6	66.0	1.6	0.7	E	varied	NR	0.1
		6	10/09/03	0836-1642	97.4	58.6	81.7	63.5	2.4	1.2	NE	varied	NR	0.0
		8	10/09/03	0840-1659	97.4	58.6	81.7	63.5	2.4	1.2	NE	varied	NR	0.0
	ID	10	10/22/03	0914-1654	97.3	22.0	79.9	34.7	3.2	1.0	W	varied	NR	0.0
		12	10/24/03	0850-1645	82.1	14.1	65.5	33.1	7.0	0.6	SW	varied	NR	0.0
		13	10/24/03	0915-1547	82.1	14.1	65.5	33.1	7.0	0.6	SW	varied	NR	0.0
		15	10/24/03	0956-1705	82.1	14.1	65.5	33.1	7.0	0.6	SW	varied	NR	0.0
		16	10/25/03	0830-1514	88.6	17.6	64.4	25.52	3.8	0.8	SW	varied	NR	0.0
		17	10/25/03	0932-1543	88.6	17.6	64.4	25.52	3.8	0.8	SW	varied	NR	0.0
	FL	22	12/10/03	0922-1408	90.3	64.5	76.8	63.3	6.5	2.8	S	varied	NR	trace
		23	12/10/03	0947-1644	90.3	64.5	76.8	63.3	6.5	2.8	S	varied	NR	trace
		26	12/11/03	0905-1427	74.9	43.5	65.1	50.9	6.9	5.2	W	varied	NR	0.0
		27	12/11/03	0846-1607	74.9	43.5	65.1	50.9	6.9	5.2	W	varied	NR	0.0
AHE62	CA	A1	07/02/09	0621-1125	69.3	29.3	86.0	63.3	3.1	1.8	NW	0-20	< 105	0.0
		A2	07/20/09	0547-0841	84.1	30.3	79.5	56.8	2.4	0.6	SE	0-20	< 105	0.0
		A3	07/24/09	0638-1112	79.6	26.8	87.4	55.4	4.4	1.4	ENE	0-20	< 105	0.0
AHE63	NY	A1	7/28/2009	0817-1850	71.4	46.3	81.7	72.0	17	0.5	SW	0-100	< 105	0.0
		A2	7/30/2009	0653-1346	94.7	58.1	76.1	63.0	8.3	0.1	SSW	0-100	< 105	0.0
		A3	8/3/2009	0647-1257	78.3	44.9	74.7	60.6	11.5	0.2	SW	0-20	< 105	0.0
		A4	8/5/2009	0749-1201	93.6	48.2	68.2	57.0	6.3	0.1	N	0-40	< 105	0.0
		A5	8/6/2009	0810-0934	77.9	67.4	66.9	63.0	5.3	0.3	SSW	0-100	< 105	0.0
AHE64	FL	A1	8/22/2009	0659-1444	84.0	36.4	81.3	63.7	10.3	0.2	ENE	0-80	< 105	0.0
		A2	8/24/2009	0833-1112	71.0	54.7	79.3	70.9	11.3	0.3	SE	0-20	< 105	0.0
		A3	8/25/2009	1005-1302	72.2	57.3	84.5	76.6	11.2	0.6	SSE	0-60	< 105	0.0
		A4	8/28/2009	0723-1041	92.0	68.2	72.3	65.1	10.6	0.2	NNW	0-40	< 105	0.0
		A5	8/29/2009	0811-1040	95.9	76.8	72.0	64.2	6.1	0.1	NW	20-100	< 105	0.0

NR = not reported

Table S - 5. Summary of Work Clothing and PPE										
Study ID	MU ID	Long-sleeved Shirt		Pants		Gloves	Eye Protection[3]	Shoe type (over socks)	Cap	Respirator Type[3]
		Style	Material	Style	Material					
AHE07	1	Button-front	Cotton	Pleated	Cotton	Rubber	--	Rubber boots	CR hat	--
	3	Button-front[1]	Cotton/Polyester	Jeans	Cotton	Rubber	Eyeglasses	Leather boots	CR hat	--
	4	Button-front	Cotton/Polyester	Pleated	Cotton	Rubber	--	Leather boots	CR hat	--
	6	T-shirt	Cotton	Pleated	Cotton	Rubber	--	Leather boots	CR hat	--
	8	Polo	Cotton/Polyester	Jeans	Cotton	Rubber	--	Rubber boots	CR hat	--
	10	Button-front	Cotton	Jeans	Cotton	Rubber	Eyeglasses	Leather boots	CR hat	--
	12	Button-front Button-front[1,2]	Light Wt Wool Cotton/Polyester	Pleated[1]	Cotton/Polyester	Rubber	--	Leather/Cloth upper boots	CR hat	--
	13	T-shirt	Cotton	Jeans	Cotton	Rubber	--	Rubber boots	CR hat	--
	15	Button-front	Cotton	Jeans	Cotton	Rubber	--	Leather boots	CR hat	--
	16	Coverall	Cotton	Coverall	Cotton	Rubber	--	Leather boots	CR hat	--
	17	Button-front	Cotton	Jeans	Cotton	Rubber	--	Leather boots	CR hat	--
	22	Button-front	Cotton/Polyester	Uniform	Cotton/Polyester	Rubber	--	Leather boots	CR hat	--
	23	Button-front	Cotton/Polyester	Uniform	Cotton/Polyester	Rubber	--	Leather boots	CR hat	--
	26	Button-front	Cotton/Polyester	Jeans	Cotton	Rubber	--	Leather boots	CR hat	--
	27	Button-front	Cotton	Jeans	Cotton	Rubber	Eyeglasses	Leather boots	CR hat	--
AHE62	A1	Button, collar	100% cotton	Dickies	cotton	Nitrile	Protective eyewear	Leather boots	CR hat	--
	A2	Button-up	cotton	Jeans	cotton	Nitrile	Protective eyewear	Leather boots	CR hat	--
	A3	Button-up	cotton	Jeans	cotton	Nitrile	Goggles	Leather shoes	CR hat	--
AHE63	A1	Button-Down	Cotton/Polyester	Jeans	Cotton	Nitrile	Eyeglasses	Leather shoes	CR hat	--
	A2	Button-Down	Cotton/Polyester	Jeans	Cotton	Nitrile	Eyeglasses	Leather boots	CR hat	Half-face
	A3	Button-Down	Cotton	Jeans	Cotton	Nitrile	--	Leather boots	CR hat	--
	A4	Button-Down	Cotton	Jeans	Cotton	Nitrile	Eyeglasses	Leather boots	CR hat	--
	A5	Button-Down	Cotton	Jeans	Cotton	Nitrile	--	Tennis shoes	CR hat	--
AHE64	A1	Button-Down	Cotton	Jeans	Cotton	Nitrile	--	Leather boots	CR hat	--
	A2	Button-Down	Cotton/Polyester	Jeans	Cotton	Nitrile	Eyeglasses	Leather shoes	CR hat	--
	A3	Button-Down	Cotton	Jeans	Cotton	Nitrile	Eyeglasses	Leather boots	CR hat	Half-face
	A4	Button-Down	Cotton	Work	Cotton	Nitrile	--	Leather boots	CR hat	--
	A5	Button-Down	Cotton/Polyester	Jeans	Cotton	Nitrile	Eyeglasses	Leather shoes	CR hat	Half-face

[1] Clothing provided by AHETF due to non-compliant clothing worn by worker.
[2] Initial shirt worn by worker was compliant – shirt replaced by AHETF after being torn by a tree branch.
[3] Per AHETF SOP 9.K, exposure is extrapolated to portions of face covered by eyewear or respiratory protection.

Table S - 6. Summary of Application Characteristics													
Study ID	MU ID	Crop				Application Equipment					Speed (mph)	Tank Size (gal)	Application / Exposure Monitoring Time
		Type	Height (ft)	Spacing (ft)		Tractor/truck	Airblast						
				Full	In-row		Brand	Nozzle					
								Type	# used	Pressure (psi)			
AHE07	1	peach	NR	NR	10-15	NR	Duran Wayland	NR	14	NR	2-4	500	5.5
	3	peach	NR	NR	10-15	NR	Agri Dynamic	NR	12	NR	2-4	500	6.6
	4	peach	NR	NR	10-15	NR	Duran Wayland	NR	14	NR	2-4	500	5.8
	6	peach	NR	NR	10-15	NR	Agri Dynamic	NR	12	NR	2-4	500	8.1
	8	peach	NR	NR	10-15	NR	Ag Tech	NR	16	NR	2-4	425	8.3
	10	apple	NR	NR	10-15	Ford 4230	GB Mistair	NR	7	NR	2-4	400	7.7
	12	apple	NR	NR	10-15	Kubota L4150	Turbomist / Victair	NR	12	NR	2-4	183	7.9
	13	apple	NR	NR	10-15	NR	Victair / Mistifier	NR	28	NR	2-4	300	6.5
	15	apple	NR	NR	10-15	NR	Duran Wayland	NR	12	NR	2-4	400	7.2
	16	apple	NR	NR	10-15	NR	FMC	NR	16	NR	2-4	500	6.7
	17	apple & pear	NR	NR	10-15	John Deere 2255	Meyers	NR	14	NR	2-4	480	6.2
	22	orange	NR	NR	15-24	John Deere 6405[b]	Rears Power Pull	NR	24	NR	2-4	1000	4.8
	23	orange	NR	NR	15-24	John Deere 6405[b]	Rears Powerblast	NR	22	NR	2-4	1000	7.0
	26	orange	NR	NR	15-24	NR[b]	FMC 957	NR	22	NR	2-4	1000	4.8
	27	orange	NR	NR	15-24	John Deere 6405[b]	Rears Power Pull	NR	24	NR	8	1000	7.4
AHE62	A1	grape	NR	NR	11	John Deere 2950[b]	International Manf. Co.	Plastic	10	90	3-3.5	600	5.1
	A2	grape	NR	NR	10	Kubota M5400	Gearmore	Spinning disc	6	40	4	150	2.9
	A3	grape	NR	NR	10	Kubota M7030N	Rears Pul-Blast	Cone	6	120	2.5	400	4.6
AHE63	A1	grape	NR	NR	9	Case IH 2140	Turbo Mist Slimline	NR	10	100	4	400	10.6
	A2	grape	NR	NR	8-10	John Deere 2355N	Berthoud Arbo AX LT600	NR	5	600	3.9	160	6.9

Table S - 6. Summary of Application Characteristics													
Study ID	MU ID	Crop				Application Equipment					Speed (mph)	Tank Size (gal)	Application / Exposure Monitoring
		Type	Height (ft)	Spacing (ft)		Tractor/truck	Airblast						
				Full	In-		Brand	Nozzle					
	A3	grape	NR	NR	8.5	Massey Ferguson 265	CIMA Blitz 45 T100	NR	10	26	3	300	6.2
	A4	grape	NR	NR	7-9	John Deere 830	Holland Windmill 350	NR	9	22	3-3.5	280	4.2
	A5	grape	NR	NR	8-9	International Case 485	Berthoud Arbo 1000	Hollow cone	12	350	2.5-3	300	1.4
AHE64	A1	pecan	NR	NR	--[a]	John Deere 300B	FMC Bean	Cone	11	20-25	2-2.5	500	7.8
	A2	pecan	NR	NR	--[a]	Ford 6600	Savage 5534	Floodjet	7	25-30	3-5	500	2.7
	A3	pecan	NR	NR	--[a]	John Deere 2940[b]	Savage 5528	Floodjet	7	20-25	3-4	500	3.0
	A4	pecan	NR	NR	--[a]	Massey Ferguson 360	Savage 5525	Floodjet	7	20	1.2	500	3.3
	A5	pecan	NR	NR	30	Kubota M4900	Savage 50	Floodjet	7	70-80	~2	500	2.5

NR = not reported
[a] Trees not in rows (non-systematic planting)
[b] Open cab vehicle with a canopy/roof.

Table S - 7. Summary of Application Rate Information												
Study ID	MU ID	Crop	Active Ingredient (ai)	Product Conc. (lb ai / gallon)	# Loads applied	Area Treated (acres)	Application Amount					
							Spray		Product		Active Ingredient	
							Per Acre (gal)	Total (gal)	Per Acre (gal)	Total (gal)	Per Acre (lb)	Total (lb)
AHE07	1	peach	Carbaryl	4.0	5	25	100	2500	0.75	19	3.0	75
	3	peach	Carbaryl	4.0	3	15	100	1500	0.75	11	3.0	45
	4	peach	Carbaryl	4.0	5	25	100	2500	0.75	19	3.0	75
	6	peach	Carbaryl	4.0	4	20	100	2000	0.75	15	3.0	60
	8	peach	Carbaryl	4.0	5	17	123	2091	0.76	13	3.1	52
	10	apple	Carbaryl	4.0	4	16	100	1600	0.50	8	2.0	32
	12	apple	Carbaryl	4.0	9	16	100	1600	0.52	8	2.1	33
	13	apple	Carbaryl	4.0	6	18	100	1800	0.50	9	2.0	36
	15	apple	Carbaryl	4.0	4	12	133	1596	0.50	6	2.0	24
	16	apple	Carbaryl	4.0	4	20	100	2000	0.50	10	2.0	40
	17	apple & pear	Carbaryl	4.0	14	17	400	6800	0.50	9	2.0	34
	22	orange	Carbaryl	4.0	2	20	100	2000	0.75	15	3.0	60
	23	orange	Carbaryl	4.0	3	30	100	3000	0.75	23	3.0	90
	26	orange	Carbaryl	4.0	6	30	200	6000	0.75	23	3.0	90
	27	orange	Carbaryl	4.0	3	30	100	3000	0.75	23	3.0	90
AHE62	A1	grape	Malathion	6.88	4	20	100	2000	0.25	5	1.7	34.3
	A2	grape	Malathion	6.61	3	12	38	450	0.06	1	0.4	5.0
	A3	grape	Malathion	6.77	3	9.5	61	575	0.16	2	1.1	10.4
AHE63	A1	grape	Carbaryl	4.06	3	24	50	1200	0.50	12	2.0	48.4
	A2	grape	Carbaryl	4.06	7	17.5	63	1100	0.50	9	2.0	35.6
	A3	grape	Carbaryl	4.06	3	12	75	900	0.50	6	2.0	24.4
	A4	grape	Carbaryl	4.06	3	7.5	100	750	0.50	4	2.0	15.2
	A5	grape	Carbaryl	4.06	2	3	100	300	0.50	2	2.0	6.1
AHE64	A1	pecan	Carbaryl	4.04	3	15	83	1250	1.04	16	4.2	63.1
	A2	pecan	Carbaryl	4.04	2	5	100	500	0.50	3	2.0	10.1
	A3	pecan	Carbaryl	4.04	2	7	86	600	1.25	9	5.0	35.3
	A4	pecan	Carbaryl	4.04	2	5	150	750	1.25	6	5.0	25.2
	A5	pecan	Carbaryl	4.04	2	9	33	300	0.50	5	2.0	18.2

Table S - 8. Descriptions of Exposure Monitoring and Analytical Methods				
Exposure Monitoring Method		**Analytical Method**		
Matrix	**Description**	**Active Ingredient**	**Identification**	**Description**
Hand Rinse	Exposure to the hands was measured using a 500 mL aliquot of 0.01% v/v AOT solution. First, 400 mL AOT solution was poured over a worker's hand while rubbing them together over a glass bowl for approximately 30 seconds; the remaining 100 mL was then poured over the worker's hands into the bowl. The bowl of 500 mL solution (now with hand residue) is transferred to a clear glass jar and frozen for storage. Samples are taken at any point a worker would normally wash their hands (e.g., during lunch breaks, before using restroom, etc.) and at the end of monitoring. Samples are analyzed separately, but summed to obtain a total daily hand exposure.	Carbaryl	ARTF-AM-012, Revision #2 ["Determination of Carbaryl in Hand Wash Solutions" (6/98)]	Carbaryl was extracted from hand wash solutions with dichloromethane, using multiple extractions. An aliquot of the extract was evaporated to dryness, reconstituted in acetonitrile:water (50:50 v/v), then submitted to HPLC analysis using post column derivatization/fluorescence detection. The method provided for an optional Florisil SPE purification step that was not needed for this study.
		Malathion	ARTF-AM-006, Revision 3, ["Determination of Diazinon and Malathion in Hand Wash Solutions"]	Malathion residues in AOT hand wash solutions were retained on a conditioned C-18 reverse phase cartridge by passing an aliquot of hand wash sample through the cartridge. The cartridge was washed with water, air-dried, then washed with hexane. Malathion residues were eluted from the C-18 cartridge with dichloromethane. The eluate was evaporated to dryness, redissolved in acetone, then submitted to gas chromatographic (GC) analysis using flame photometric detection in the phosphorous mode (FPD/P).
Face/neck Wipe	The face/neck wipes consisted of two 4" x 4", 100% cotton gauze Kendall Curity sponges moistened with 4 mL of 0.01% (v/v) Aerosol® OT solution (sodium dioctyl sulfosuccinate in distilled water), used sequentially. Face/neck wipes were conducted prior to breaks and at the end of monitoring. Samples were combined for analysis.	Carbaryl	ARTF-AM-014, Revision 2 ["Determination of Carbaryl in Cotton Facial/Neck Wipes" (4/98)]	Carbaryl was extracted from cotton face/neck wipes with acetone. The aluminum foil used to wrap each sample was also rinsed with acetone to remove any residues. An aliquot of the extract was concentrated, subjected to Florisil SPE cleanup (most extracts), then submitted to high performance liquid chromatographic (HPLC) analysis using post column derivatization/fluorescence detection.
		Malathion	ARTF-AM-010, Revision 2, ["Determination of Diazinon and Malathion in Cotton Facial/Neck Wipes"]	Malathion was extracted from cotton facial/neck wipes with an aqueous AOT solution. The aluminum foil used to wrap each sample was also rinsed with aqueous AOT to remove any residues. An aliquot of the extract was subjected to C-18 cleanup. After the sample was passed through the cartridge, retaining the

Table S - 8. Descriptions of Exposure Monitoring and Analytical Methods				
Exposure Monitoring Method		**Analytical Method**		
Matrix	**Description**	**Active Ingredient**	**Identification**	**Description**
				analyte, the cartridge was washed with water, then air-dried. Malathion residues were eluted from the C-18 cartridge with dichloromethane:methanol (50:50, v/v). The eluate was evaporated to dryness and redissolved in acetone.
Inner Dosimeters	Whole body dosimeters – white, long underwear, 100% cotton one-piece Carolina Mills, Inc. union suits worn underneath the workers' outer clothing – served to represent the workers' skin on their arms, legs and torso. Following each monitoring period, the inner whole body dosimeters were carefully removed and sectioned into two pieces: lower body (below the waist) and upper body (above the waist).	Carbaryl	ARTF-AM-011, Revision 4 ["Determination of Carbaryl in Dermal Dosimeters", (9/29/03)]	Carbaryl was extracted from cotton inner dosimeter sections (upper and lower) with acetone. Each section was considered one analytical sample. An aliquot of the sample extract was subjected to Florisil SPE cleanup, then submitted to high performance liquid chromatographic analysis using post column derivatization/fluorescence detection. The method, incorporating Florisil cleanup, is applicable to samples containing residue levels ranging from 1.0 µg/sample to 500 µg/sample for inner dosimeters. A provision was made to extend the range of applicability by eliminating the Florisil cleanup.
		Malathion	ARTF-AM-005, Revision 4 (by ABC Laboratories, Inc.) ["Determination of Diazinon/Malathion Inner Dermal Dosimeters", 3/98]	Malathion was extracted from cotton inner dosimeter sections with acetone. The aluminum foil used to wrap each sample was also rinsed with acetone to remove any residues. Following evaporation of the solvent from an aliquot of the extract, the residues were suspended in water, then partitioned into hexane; the hexane was back-extracted against water. An aliquot of the hexane extract was subjected to Florisil Bond Elut cleanup.

Table S - 8. Descriptions of Exposure Monitoring and Analytical Methods				
Exposure Monitoring Method		**Analytical Method**		
Matrix	**Description**	**Active Ingredient**	**Identification**	**Description**
OVS tubes	Air sampling was conducted using OSHA Versatile Sampler (OVS) tubes connected by Tygon®-type tubing to a SKC model 110-100 personal air sampling pump set to approximately 2 liters per minute. The sample collector consisted of a glass fiber filter and two sections of XAD-2 sorbent housed in a 13 mm diameter glass tube. The sampler was clipped to the worker's collar (intake facing downward) and the tube attached to their belt. Pump on/off times and starting and ending flow rates were recorded.	Carbaryl	ARTF-AM-013, Revision 2, ["Determination of Carbaryl in OVS Air Sampling Tubes" (12/17/09)]	Air sampling tube contents were divided into front and back sections and the sections were analyzed separately. Carbaryl was extracted from the contents of each section of sorbent tube with acetonitrile. An aliquot of the extract was evaporated to dryness, reconstituted in acetonitrile:water (50:50, v/v) then submitted to HPLC analysis using post column derivatization/fluorescence detection. The method provided for an optional Florisil SPE purification step that was not needed for this study.
		Malathion	ARETF-AM-009, Revision 5, ["Determination of Diazinon and Malathion in OVS Air Sampling Tubes"]	Air sampling tube contents were divided into front and back sections and the sections were analyzed separately. Malathion was extracted from the contents of each section of sorbent tube with acetone. An aliquot of the extract was evaporated to dryness, then reconstituted in acetone. Samples were submitted to gas chromatographic (GC) analysis using flame photometric detection in the phosphorous mode (FPD/P).
Head Patch	The inner head patch consisted of one layer of inner dosimeter material (a one-piece, white, long-underwear union suit constructed of 100% cotton) measuring 100 square centimeters. Extra material was used for the attachment of strings, which ran under the chin of the worker to hold the patch in place. The patch was worn on the crown of the head, under the chemical-resistant hat for the duration of the monitoring period.	Carbaryl	ARTF-AM-011, Revision 4 ["Determination of Carbaryl in Dermal Dosimeters", (9/29/03)]	Carbaryl was extracted from head patch samples with acetone. Each section was considered one analytical sample. An aliquot of the sample extract was subjected to Florisil SPE cleanup, then submitted to high performance liquid chromatographic analysis using post column derivatization/fluorescence detection. The method, incorporating Florisil cleanup, is applicable to samples containing residue levels ranging from 1.0 µg/sample to 500 µg/sample for inner dosimeters. A provision was made to extend the range of applicability by eliminating the Florisil cleanup.
		Malathion	ARTF-AM-005, Revision 4, modifications dated 11/16/09, ["Determination of Diazinon/Malathion Inner Dermal Dosimeters", 3/98]	Malathion was extracted from head patch samples with acetone. The aluminum foil used to wrap each sample was also rinsed with acetone to remove any residues. Following evaporation of the solvent from an aliquot of the extract, the residues were suspended in

Table S - 8. Descriptions of Exposure Monitoring and Analytical Methods				
Exposure Monitoring Method		**Analytical Method**		
Matrix	**Description**	**Active Ingredient**	**Identification**	**Description**
				water, then partitioned into hexane; the hexane was back-extracted against water. An aliquot of the hexane extract was subjected to Florisil Bond Elut cleanup.

Table S - 9. Field Control Samples with Detected Residues						
Study	**Control Sample Type**	**# with detected residues**	**Sample ID**	**Residue Found (ug/sample)**	**LOQ (ug/sample)**	**Comparison to LOQ**
AHE07	Face/Neck wipe	1 of 12	07-FF-02-FW-C1	1.08	0.05	1.1X > LOQ
	OVS tube (both sections)	3 of 12	07-FF-05-AR-C1	0.0127	0.01	1.3X > LOQ
			07-FF-05-AR-C2	0.0143	0.01	1.4X > LOQ
			07-FF-04-AR-C1	0.0210	0.01	2X > LOQ
AHE62	Head patch (inner and outer)	5 of 8	62-FF-01-IH-C3	0.2145	0.25	1.2 X < LOQ
			62-FF-01-IH-C4	0.1862	0.25	1.3 X < LOQ
			62-FF-02-IH-C1	0.1460	0.25	1.7 X < LOQ
			62-FF-02-IH-C2	0.1225	0.25	2 X < LOQ
			62-FF-02-OH-C2	0.1730	0.25	1.4X < LOQ
	OVS tube (front section)	4 of 4	62-FF-02-AR-C1	0.00658	0.005	1.3X > LOQ
			62-FF-02-AR-C2	0.01497	0.005	3X > LOQ
			62-FF-02-AR-C1	0.67812	0.005	136X > LOQ
			62-FF-02-AR-C2	0.75075	0.005	150X > LOQ
AHE63	Inner Dosimeter	3 of 5	63-FF-01-ID-C2	0.10	1.0	10X < LOQ
			63-FF-01-ID-C2 (confirmatory)	0.11	1.0	9X < LOQ
			63-FF-04-ID-C1	0.10	1.0	10X < LOQ
	Head patch (inner and outer)	3 of 8	63-FF-01-IH-C1	0.119	0.25	2X < LOQ
			63-FF-01-IH-C2	0.087	0.25	3X < LOQ
			63-FF-04-IH-C2	0.059	0.25	4X < LOQ
	OVS tube (front section)	4 of 4	63-FF-02-AR-C1	0.03652	0.005	7 > LOQ
			63-FF-02-AR-C2	0.02751	0.005	5.5 > LOQ
			63-FF-02-AR-C1	0.00219	0.005	2.3 < LOQ
			63-FF-02-AR-C2	0.00416	0.005	1.2 < LOQ
	Face/Neck wipe	1 of 4	63-FF-01-FW-C2	0.32	1.0	3X < LOQ
	Hand Wash	1 of 4	63-FF-01-HW-C1	0.33	1.0	3X < LOQ
AHE64	Inner Dosimeter	1 of 4	64-FF-04-ID-C2	0.04	1.0	25X < LOQ
	Head patch (inner and outer)	2 of 8	64-FF-04-OH-C1	0.121	0.25	2X < LOQ
			64-FF-04-OH-C2	0.098	0.25	2.6X < LOQ
	Hand wash	1 of 4	64-FF-02-HW-C2	0.18	1.0	5.6X < LOQ
	OVS tube (front section)	4 of 4	64-FF-02-AR-C1	0.0153	0.005	3X > LOQ
			64-FF-02-AR-C2	0.01124	0.005	2.2X > LOQ
			64-FF-02-AR-C1	0.00238	0.005	2X < LOQ
			64-FF-02-AR-C2	0.00234	0.005	2X < LOQ
Note: as only negative controls for matrices with detected residues are shown in this table, it follows that all other negative controls for those matrices not presented in this table did not have detected residues (i.e., only a small percentage of all negative controls had detected residues).						

Table S - 10. Summary of Concurrent Laboratory Fortification Samples				
Study ID	**Exposure Matrix**		**Fortification Range**	**Recovery Results (mean ± standard deviation)**
AHE07[a]	Inner Dosimeters		0.25 – 10000 ug/sample	101 ± 7.6% (n=58)
	Face/Neck Wipes		1.0 – 5000 ug/sample	93.0% ± 9.2% (n=21)
	Head Patch	Inner	0.25 – 500 ug/sample	96.6% ± 8.4% (n=19)
		Outer	0.25 – 10000 ug/sample	96.7% ± 7.2% (n=20)
	Hand Washes		1.0 – 5000 ug/sample	104% ± 6.2% (n=26)
	OVS Air Samplers		0.05 – 200 ug/sample	93.7% ± 11% (n=16)
	Socks		0.25 – 500 ug/sample	102% ± 8.0% (n=21)
AHE62	Inner Dosimeters		1.0 – 2000 ug/sample	102% ± 7.3% (n=6)
	Head Patch	Inner	0.25 – 100 ug/sample	105% ± 9.2% (n=4)
		Outer	0.25 – 5000 ug/sample	107% ± 8.6% (n=4)
	Face/Neck Wipes		1.0 – 2000 ug/sample	108% ± 14% (n=4)
	Hand Washes		1.0 – 2000 ug/sample	106% ± 6.9% (n=6)
	OVS Air Samplers		0.005 – 100 ug/sample	111% ± 6.8% (n=6)
AHE63[b]	Inner Dosimeters		1.0 – 2500 ug/sample	95.2% ± 10.8% (n=13)
	Head Patch	Inner	0.25 – 100 ug/sample	93.7% ± 18.6% (n=4)
		Outer	0.25 – 6000 ug/sample	95.6% ± 12.3% (n=7)
	Face/Neck Wipes		1.0 – 2000 ug/sample	101% ± 6.8% (n=8)
	Hand Washes		1.0 – 2000 ug/sample	104% ± 6.5% (n=8)
	OVS Air Samplers		0.005 – 100 ug/sample	94.9% ± 14.9% (n=12)
AHE64	Inner Dosimeters		1.0 – 55000 ug/sample	105% ± 11.1% (n=15)
	Head Patch	Inner	0.25 – 100 ug/sample	100% ± 28.2% (n=4)
		Outer	0.25 – 15000 ug/sample	101% ± 6.4% (n=7)
	Face/Neck Wipes		1.0 – 4000 ug/sample	98.6% ± 10.2% (n=7)
	Hand Washes		1.0 – 2000 ug/sample	102% ± 7.1% (n=6)
	OVS Air Samplers		0.005 – 100 ug/sample	99.5% ± 13.6% (n=12)

[a] Anomalous samples: 1 sock (193%), 1 OVS air samplers (267%), 1 inner dosimeter (58%)
[b] Anomalous samples: 1 OVS air sample (278%)

Table S – 11. Inner Whole Body Dosimeter Samples: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors									
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**			**Field Recovery Adjustment Factor by Measured Residue Range (ug)[a]**		
				Low level (5 ug)	**Mid level (100 ug)**	**High level (2000 ug)**	**≤ 52.5 ug**	**> 52.5 ug to ≤ 1050 ug**	**> 1050 ug**
AHE62	Malathion	7/02/09		43.0	105	101	0.746	0.958	1.10
				36.8	87.2	98.0			
				31.8	92.8	101			
		7/20/09		118	65.0	126			
				105	112	117			
				113	113	118			
		Summary Statistics	Mean	74.6	95.8	110			
			SD	41.3	18.3	11.6			
			CV (%)	55	19	11			
AHE63	Carbaryl	7/28/09[b]		77.3	16.3	50.0	0.912	0.834	0.882
				83.7	89.4	136			
				25.2	51.5	163			
		8/5/09		92.8	92.8	126			
				88.5	94.6	88.0			
				92.3	62.8	50.6			
		Summary Statistics	Mean	91.2	83.4	88.2			
			SD	2.4	17.9	37.7			
			CV (%)	2.6	21	43			
AHE64	Carbaryl	8/24/09		77.2	91.8	102	0.843	0.899	0.992
				81.6	78.7	103			
				95.4	71.1	99.4			
		8/28/09		95.0	94.1	88.5			
				77.0	107	98.1			
				79.5	96.7	104			
		Summary Statistics	Mean	84.3	89.9	99.2			
			SD	8.62	13.0	5.68			
			CV (%)	10	14	5.7			

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 52.5 is the midpoint between 5 and 100 ug. Field sample residue results ≤ 52.5 ug would use the adjustment factor corresponding to the low level recovery mean.

[b] Study day's results not used. The cause of the abnormally low and high results reported as unknown.

Table S – 12. AHE07 – Inner Whole Body Dosimeter Samples: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors										
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**				**Field Recovery Adjustment Factor by Measured Residue Range (ug)[a]**			
				Low level (ug)	**Mid level (ug)**	**High level (ug)**		**≤52.5**	**>52.5 to ≤300**	**>300 to ≤2750**	**>2750**
				5	**100**	**500**	**5000**				
AHE07	Carbaryl	10/07/03		100	99.6	104.8	113.2	0.845	0.977	0.98	1.07
				94.2	96.0	97.2	114.4				
				90	101.0	97.4	113.5				
				--		--	104.6				
		10/08/03		101.6	101.0	101.2	108.2				
				93.0	104.0	94.8	103.6				
				89.2	105.0	104.6	105.6				
		10/22/03		75.2	100.0	96.4	112.6				
				74.8	99.7	98.2	109.4				
				76.0	96.7	98.6	118.6				
		10/24/03		70.8	92.5	98.6	107.2				
				67.6	101.0	103.2	105.6				
				73.0	101.0	103.0	107.8				
		12/09/03		116.6	87.4	97.4	100.0				
				85.0	99.4	100.2	101.0				
				80.2	97.0	94.6	103.4				
		12/11/03		66.6	92.5	86.2	105.2				
				83.8	91.7	95.0	100.8				
				83.2	92.2	93.2	104.4				
		Summary Statistics	Mean	84.5	97.7	98.0	107.3				
			SD	13.2	4.7	4.6	5.1				
			CV (%)	16	4.8	4.7	5.3				

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 52.5 is the midpoint between 5 and 100 ug. Residue results ≤ 52.5 ug would use the adjustment factor corresponding to the low level recovery mean.

Table S – 13. Face/Neck Wipe Samples: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors									
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**			**Field Recovery Adjustment Factor by Measured Residue Range (ug)[a]**		
				Low level (5 ug)	**Mid level (100 ug)**	**High level (2000 ug)**	**≤ 52.5 ug**	**> 52.5 ug to ≤ 1050 ug**	**> 1050 ug**
AHE62	Malathion	7/02/09		87.6	79.4	81.2	1.02	0.928	0.924
				89.4	76.4	82.4			
				87.4	86.0	72.6			
		7/20/09		117	103	101			
				115	106	108			
				116	106	109			
		Summary Statistics	Mean	102	92.8	92.4			
			SD	15.3	13.8	15.6			
			CV (%)	15	15	17			
AHE63	Carbaryl	7/28/09		104	100	105	0.983	0.899	1.06
				97.5	88.5	94.9			
				98.9	102	95.6			
		8/5/09		97.0	87.4	129			
				98.2	78.1	101			
				94.2	83.4	111			
		Summary Statistics	Mean	98.3	89.9	106			
			SD	3.2	9.4	12.7			
			CV (%)	3.3	10	12			
AHE64	Carbaryl	8/24/09		89.7	88.7	88.5	0.878	0.847	0.917
				91.9	92.2	96.4			
				92.5	86.3	53.3			
		8/28/09		83.7	80.8	111			
				82.2	75.4	103			
				86.5	84.9	97.7			
		Summary Statistics	Mean	87.8	84.7	91.7			
			SD	4.30	5.94	20.2			
			CV (%)	5	7	22			

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 52.5 is the midpoint between 5 and 100 ug. Residue results ≤ 52.5 ug would use the adjustment factor corresponding to the low level recovery mean.

Table S – 14. AHE07 – Face/Neck Wipe Samples: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors							
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**		**Field Recovery Adjustment Factor by Measured Residue Range (ug)[a]**	
				Low level (ug)	**High level (ug)**	**≤52.5**	**>52.5**
				5	**100**		
AHE07	Carbaryl	10/07/03		89.8	79.4	0.849	0.955
				87.4	89.6		
				80.6	81.4		
		10/08/03		92.8	91.7		
				69.8	88.4		
				77.0	87.7		
		10/22/03		94.6	101.0		
				88.4	103.0		
				85.6	104.0		
		10/24/03		93.4	94.8		
				89.4	93.4		
				95.0	109.0		
		12/09/03		76.8	93.5		
				83.2	97.7		
				73.8	95.6		
		12/11/03		86.4	100.0		
				82.0	103.0		
				81.6	105.0		
		Summary Statistics	Mean	84.9	95.5		
			SD	7.3	8.2		
			CV (%)	8.6	8.6		

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 52.5 is the midpoint between 5 and 100 ug. Residue results ≤ 52.5 ug would use the adjustment factor corresponding to the low level recovery mean.

Table S – 15. Hand Wash Samples: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors									
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**			**Field Recovery Adjustment Factor by Measured Residue Range (ug)[a]**		
				Low level (5 ug)	**Mid level (100 ug)**	**High level (2000 ug)**	**≤ 52.5 ug**	**> 52.5 ug to ≤ 1050 ug**	**> 1050 ug**
AHE62	Malathion	7/02/09		93.0	91.0	103	0.984	0.933	0.982
				92.6	90.2	106			
				93.8	96.6	92.8			
		7/20/09		106	100	95.6			
				105	90.4	93.6			
				100	91.8	98.0			
		Summary Statistics	Mean	98.4	93.3	98.2			
			SD	6.1	4.0	5.3			
			CV (%)	6.2	4.3	5.4			
AHE63	Carbaryl	7/28/09		106	113	113	1.11	1.10	1.13
				106	112	106			
				105	98.9	110			
		8/5/09		113	108	114			
				113	112	109			
				121	114	123			
		Summary Statistics	Mean	111	110	113			
			SD	6.2	5.6	5.9			
			CV (%)	5.6	5.1	5.2			
AHE64	Carbaryl	8/24/09		105	106	114	1.05	1.03	1.12
				109	107	113			
				105	106	113			
		8/28/09		100	98.2	110			
				103	102	111			
				106	98.7	111			
		Summary Statistics	Mean	105	103	112			
			SD	3.01	3.91	1.55			
			CV (%)	2.9	3.8	1.4			

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 52.5 is the midpoint between 5 and 100 ug. Residue results ≤ 52.5 ug would use the adjustment factor corresponding to the low level recovery mean.

Table S – 16. AHE07 – Hand Wash Samples: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors							
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**		**Field Recovery Adjustment Factor by Measured Residue Range (ug)[a]**	
				Low level (ug)	**High level (ug)**	**≤52.5**	**>52.5**
				5	**100**		
AHE07	Carbaryl	10/07/03		91.4	106.0	0.997	0.966
				98.2	105.0		
				101.8	100.0		
		10/08/03		96.6	106.0		
				102.2	89.1		
				104.4	91.5		
		10/22/03		104.2	109.0		
				108.8	86.4		
				107.4	98.6		
		10/24/03		112.4	85.0		
				101.8	107.0		
				104.2	106.0		
		12/09/03		98.2	81.1		
				89.2	89.9		
				97.4	83.5		
		12/11/03		93.4	90.6		
				92.2	104.0		
				90.0	100.0		
		Summary Statistics	Mean	99.7	96.6		
			SD	6.7	9.4		
			CV (%)	6.7	9.7		

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 52.5 is the midpoint between 5 and 100 ug. Residue results ≤ 52.5 ug would use the adjustment factor corresponding to the low level recovery mean.

Table S – 17. OVS Air Samples: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors									
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**			**Field Recovery Adjustment Factor by Measured Residue Range[a]**		
				Low level (0.05 ug)	**Mid level (0.5 ug)**	**High level (100 ug)**	**≤ 0.275 ug**	**> 0.275 ug to ≤ 50.25 ug**	**> 50.25 ug**
AHE62	Malathion	7/02/09		133	114	134	1.18	1.05	1.20
				101	101	114			
				119	101	117			
		7/20/09[b]		2014	195	112			
				570	171	104			
				1103	192	103			
		Summary Statistics	Mean	118	105	122			
			SD	16.0	7.5	10.8			
			CV (%)	14	7	9			
AHE63	Carbaryl	7/28/09		90.4	87.2	116	1.08	0.990	1.07
				127	92.4	113			
				130	90.6	109			
		8/5/09		95.7	104	101			
				107	111	106			
				95.3	109	95.6			
		Summary Statistics	Mean	108	99.0	107			
			SD	17.1	10.2	7.6			
			CV (%)	16	10	7			
AHE64	Carbaryl	8/24/09		120	90.7	106	1.16	1.04	1.13
				147	94.8	108			
				108	104	124			
		8/28/09		103	112	113			
				106	107	114			
				113	115	110			
		Summary Statistics	Mean	116	104	113			
			SD	16.2	9.54	6.38			
			CV (%)	14	9	6			

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 0.275 is the midpoint between 0.05 and 0.5 ug. Residue results ≤ 0.275 ug would use the adjustment factor corresponding to the low level recovery mean.

[b] Contamination suspected, thus results not used.

Table S – 18. AHE07 – OVS Air Samples: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors							
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**		**Field Recovery Adjustment Factor by Measured Residue Range[a]**	
				Low level (ug)	**High level (ug)**	**≤ 25.025**	**> 25.025**
				0.05	**50**		
AHE07	Carbaryl	10/07/03		116.2	103.4	1.09	1.01
				109.2	110.8		
				113.8	106.6		
		10/08/03		112.6	112.4		
				114.2	109.2		
				113.0	109.0		
		10/22/03		116.8	109.8		
				119.4	99.4		
				125.2	101.8		
		10/24/03		135.6	99.4		
				120.0	100.2		
				196.2[b]	98.6		
		12/09/03		88.2	99.4		
				94.6	98.2		
				94.8	95.8		
		12/11/03		100.6	95.6		
				102.8	72.6		
				82.6	98.6		
		Summary Statistics	Mean	109.4	101.2		
			SD	13.8	9.0		
			CV (%)	13	9		

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 25.025 is the midpoint between 0.05 and 50 ug. Residue results ≤ 25.025 ug would use the adjustment factor corresponding to the low level recovery mean.

[b] Sample excluded as a statistical outlier.

Table S - 19. Outer Head Patches: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors							
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**		**Field Recovery Adjustment Factor by Measured Residue Range[a]**	
				Low level (ug)	**High level (ug)**	**≤ 2550**	**> 2550**
				100	**5000**		
AHE07	Carbaryl	10/07/03		93.9	91.6	0.869	1.02
				95.7	106.8		
				102.0	108.6		
		10/08/03		100.0	107.8		
				90.9	104.4		
				97.3	108.6		
		10/22/03		85.6	105.8		
				92.3	107.6		
				74.4	104.8		
		10/24/03		84.5	104.8		
				85.2	102.8		
				81.9	98.8		
		12/09/03		75.8	97.0		
				78.9	97.2		
				84.5	96.2		
		12/11/03		83.9	96.6		
				78.0	97.2		
				79.3	94.2		
		Summary Statistics	Mean	86.9	101.7		
			SD	8.4	5.5		
			CV (%)	10	5.4		
AHE62	Malathion	7/02/09		92.2	124	1.06	1.20[c]
				107	125		
				-- [b]	-- [b]		
		7/20/09		112	122		
				103	116		
				114	123		
		Summary Statistics	Mean	106	122		
			SD	8.7	3.5		
			CV (%)	8.2	3		
AHE63	Carbaryl	7/28/09		43.7	91.5	0.544	0.971
				50.1	102		

Table S - 19. Outer Head Patches: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors							
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**		**Field Recovery Adjustment Factor by Measured Residue Range[a]**	
				Low level (ug)	**High level (ug)**	**≤ 2550**	**> 2550**
				100	**5000**		
				56.8	91.4		
		8/5/09		54.8	104		
				59.5	104		
				61.6	89.9		
		Summary Statistics	Mean	54.4	97.1		
			SD	6.6	6.9		
			CV (%)	12	7.1		
AHE64	Carbaryl	8/24/09		63.3	84.3	0.796	0.952
				61.7	95.7		
				63.7	101		
		8/28/09		104	92.9		
				94.7	100		
				90.2	97.5		
		Summary Statistics	Mean	79.6	95.2		
			SD	18.8	6.10		
			CV (%)	24	6.4		

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 2550 is the midpoint between 100 and 5000 ug. Residue results ≤ 2550 ug would use the adjustment factor corresponding to the low level recovery mean.
[b] Sample not taken.
[c] Per AHETF SOPs, recovery means greater than 120% will use a maximum adjustment factor of 1.2

Table S – 20. AHE62 – Inner Head Patches: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors									
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**			**Field Recovery Adjustment Factor by Measured Residue Range[a]**		
				Low level (5 ug)	**Mid level (100 ug)**	**High level (2000 ug)**	**≤ 52.5 ug**	**> 52.5 ug to ≤ 1050 ug**	**> 1050 ug**
AHE62	Malathion	7/02/09		88.0	--	99.3	1.01	1.09	1.05
				97.1	--	110			
				--[b]	--	--[b]			
		7/20/09[b]		104	108	--			
				103	108	--			
				115	111	--			
		Summary Statistics	Mean	101	109	105			
			SD	9.9	1.7	7.6			
			CV (%)	10	16	7.2			

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 52.5 is the midpoint between 5 and 100 ug. Residue results ≤ 52.5 ug would use the adjustment factor corresponding to the low level recovery mean.
[b] Sample not taken.

Table S – 21. Inner Head Patches: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors							
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**		**Field Recovery Adjustment Factor by Measured Residue Range[a]**	
				Low level (ug)	**High level (ug)**	**≤ 52.5**	**> 52.5**
				5	**100**		
AHE07	Carbaryl	10/07/03		94.6	108.0	0.837	0.981
				96.6	105.0		
				99.8	107.0		
		10/08/03		99.2	112.0		
				95.0	110.0		
				93.8	108.0		
		10/22/03		75.0	85.0		
				79.4	83.2		
				76.4	105.0		
		10/24/03		78.0	92.1		
				83.8	85.8		
				72.4	92.9		
		12/09/03		71.6	84.3		
				72.2	87.4		
				73.2	90.1		
		12/11/03		75.6	129.0		
				76.4	89.9		
				92.8	90.4		
		Summary Statistics	Mean	83.7	98.1		
			SD	10.6	12.7		
			CV (%)	13	13		
AHE63	Carbaryl	7/28/09		93.6	57.5	0.692	0.524
				74.2	65.6		
				81.4	61.1		
		8/5/09		59.7	50.0		
				48.0[b]	43.1[b]		
				58.2	37.1[b]		
		Summary Statistics	Mean	69.2	52.4		
			SD	16.9	11.0		
			CV (%)	24	21		
AHE64	Carbaryl	8/24/09		75.1	97.1	0.810	0.870
				79.4	79.2		

Table S – 21. Inner Head Patches: Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors							
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**		**Field Recovery Adjustment Factor by Measured Residue Range[a]**	
				Low level (ug)	**High level (ug)**	**≤ 52.5**	**> 52.5**
				5	**100**		
				69.8	84.3		
		8/28/09		86.3	100		
				92.6	88.3		
				82.6	73.2		
		Summary Statistics	Mean	81.0	87.0		
			SD	8.10	10.3		
			CV (%)	10	12		

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 52.5 is the midpoint between 5 and 100 ug. Residue results ≤ 52.5 ug would use the adjustment factor corresponding to the low level recovery mean.
[b] Cause of low recovery not known.

Table S - 22. Socks (AHE07 only): Summary of Field Fortification Recovery Samples and Corresponding Adjustment Factors									
Study ID	**Active Ingredient**	**Monitoring Date**		**Field Fortification Recovery (%)**			**Field Recovery Adjustment Factor by Measured Residue Range[a]**		
				Low level (ug)	**Mid level (ug)**	**High level (ug)**	**≤ 52.5**	**> 52.5 ug to ≤ 300 ug**	**> 300**
				5	**100**	**500**			
AHE07	Carbaryl	10/07/03		82.8	91.1	77.6	0.692	0.775	0.925
				88.6	90.8	93.2			
				85.2	90.0	96.8			
		10/08/03		86.6	89.2	104.0			
				88.0	88.2	107.6			
				87.8	87.6	105.0			
		10/22/03		48.2	72.6	89.2			
				54.0	69.7	91.2			
				71.0	69.3	86.0			
		10/24/03		61.2	77.5	97.2			
				65.8	78.8	81.2			
				64.2	79.3	111.4			
		12/09/03		58.2	70.3	88.4			
				58.8	71.1	71.6			
				57.6	67.1	83.8			
		12/11/03		58.0	67.2	93.2			
				64.4	69.9	91.0			
				65.0	64.6	86.8			
		Summary Statistics	Mean	69.2	77.5	92.5			
			SD	13.6	9.6	10.2			
			CV (%)	20	12	11			

[a] Adjustment factor corresponds to mean recovery percentage for each recovery level. Residue range corresponds to midpoint between each fortification level. Example: 52.5 is the midpoint between 5 and 100 ug. Residue results ≤ 52.5 ug would use the adjustment factor corresponding to the low level recovery mean.
[b] Cause of low recovery not known.

Table S – 23. Inner Dosimeter (Arms): Field Sample Results										
Study ID	MU ID	Active Ingredient	Analytical Method Levels (ug/sample)[a]		Lower Arm			Upper Arm		
			LOQ	LOD	Raw Exp.[b]	FFAF[c]	Adj. Exp. (ug)[d]	Raw Exp.[b]	FFAF[c]	Adj. Exp. (ug)[d]
AHE07	1	Carbaryl	0.25	--	73.7	0.977	75.4	39.4	0.845	46.6
	3				1230	0.98	1255	168	0.977	172
	4				192	0.977	197	36.4	0.845	43.1
	6				348	0.98	355	128	0.977	131
	8				890	0.98	908	237	0.977	243
	10				1387	0.98	1415	1754	0.98	1790
	12				230	0.977	235	97	0.977	99.3
	13				230	0.977	235	208	0.977	213
	15				711	0.98	726	660	0.98	673
	16				326	0.98	333	59.4	0.977	60.8
	17				44.9	0.845	53.1	21.2	0.845	25.1
	22				521	0.98	532	278	0.977	285
	23				985	0.98	1005	285	0.977	292
	26				783	0.98	799	589	0.98	601
	27				5380	1.07	5028	3090	1.07	2888
AHE62	A1	Malathion	1.0	0.3	25.28	0.746	33.9	20.92	0.746	28.0
	A2				51.9	0.746	69.6	45.1	0.746	60.5
	A3				82.7	0.958	86.3	12.0	0.746	16.1
AHE63	A1	Carbaryl	1.0	0.3	1085	0.882	1230	1064	0.882	1206
	A2				3069	0.882	3480	1520	0.882	1723
	A3				244	0.834	293	48.5	0.912	53.2
	A4				4.6	0.912	5.0	2.7	0.912	3.0
	A5				40.1	0.912	44.0	44.4	0.912	48.7
AHE64	A1	Carbaryl	1.0	0.3	1041	0.899	1158	221	0.899	246
	A2				5106	0.992	5147	3381	0.992	3408
	A3				345	0.899	384	78.6	0.899	87.4
	A4				5586	0.992	5631	1647	0.992	1660
	A5				1.7	0.843	2.0	< LOQ	--	0.50

[a] When < LOQ or < LOD is reported, ½ LOQ or ½ LOD is used. Note no LOD was derived for AHE07 for any sampling matrix.
[b] Calculated from chromatogram peak response (e.g., ug/mL)
[c] FFAF=field fortification adjustment factor. From Supplemental Tables S – 11a-b.
[d] Adjusted Exposure = Raw exposure ÷ Field Fortification Adjustment Factor

Table S – 24. Inner Dosimeter (Torso): Field Sample Results											
Study ID	MU ID	Active Ingredient	Analytical Method Levels (ug/sample)[a]		Front Torso			Rear Torso			
			LOQ	LOD	Raw Exp.[b]	FFAF[c]	Adj. Exp. (ug)[d]	Raw Exp.[b]	FFAF[c]	Adj. Exp. (ug)[d]	
AHE07	1	Carbaryl	0.25	--	20.2	0.845	23.9	21.6	0.845	25.6	
	3				353	0.98	360	152	0.977	156	
	4				87.9	0.977	90.0	37	0.845	43.8	
	6				157	0.977	161	101	0.977	103	
	8				417	0.98	426	270	0.977	276	
	10				232	0.977	237	547	0.98	558	
	12				97.6	0.977	99.9	50.6	0.845	59.9	
	13				178	0.977	182	158	0.977	162	
	15				704	0.98	718	368	0.98	376	
	16				207	0.977	212	69.5	0.977	71.1	
	17				31.5	0.845	37.3	12.8	0.845	15.1	
	22				485	0.98	495	304	0.98	310	
	23				593	0.98	605	895	0.98	913	
	26				539	0.98	550	501	0.98	511	
	27				3660	1.07	3421	2630	0.98	2684	
AHE62	A1	Malathion	1.0	0.3	44.2	0.746	59.2	17.3	0.746	23.2	
	A2				50.2	0.746	67.3	54.9	0.958	57.3	
	A3				78.7	0.958	82.2	13.5	0.746	18.1	
AHE63	A1	Carbaryl	1.0	0.3	1985	0.882	2251	419	0.834	502	
	A2				833	0.834	999	402	0.834	482	
	A3				153	0.834	183	79.9	0.834	96	
	A4				2.2	0.912	2.4	5.5	0.912	6.0	
	A5				49.3	0.912	54.1	23.0	0.912	25.2	
AHE64	A1	Carbaryl	1.0	0.3	427	0.899	475	280	0.899	311	
	A2				3531	0.992	3559	3642	0.992	3671	
	A3				131	0.899	146	38.9	0.843	46.1	
	A4				1561	0.992	1574	5448	0.992	5492	
	A5				< LOQ	--	0.50	< LOQ	--	0.50	

[a] When < LOQ or < LOD is reported, ½ LOQ or ½ LOD is used. Note no LOD was derived for AHE07 for any sampling matrix.
[b] Calculated from chromatogram peak response (e.g., ug/mL)
[c] FFAF=field fortification adjustment factor. From Supplemental Tables S – 11a-b.
[d] Adjusted Exposure = Raw exposure ÷ Field Fortification Adjustment Factor

Table S – 25. Inner Dosimeter (Legs): Field Sample Results											
Study ID	MU ID	Active Ingredient	Analytical Method Levels (ug/sample)[a]		Lower Leg			Upper Leg			
			LOQ	LOD	Raw Exp.[b]	FFAF[c]	Adj. Exp. (ug)[d]	Raw Exp.[b]	FFAF[c]	Adj. Exp. (ug)[d]	
AHE07	1	Carbaryl	0.25	--	24.6	0.845	29.1	82.7	0.977	84.6	
	3				26.8	0.845	31.7	187	0.977	191	
	4				9.3	0.845	11.0	67	0.977	68.6	
	6				10	0.845	11.8	43.7	0.845	51.7	
	8				109	0.977	112	531	0.98	542	
	10				15.6	0.845	18.5	64.2	0.977	65.7	
	12				12.5	0.845	14.8	41.7	0.845	49.3	
	13				97.2	0.977	99.5	204	0.977	209	
	15				43.8	0.845	51.8	326	0.98	333	
	16				165	0.977	169	319	0.98	326	
	17				12.5	0.845	14.8	12.8	0.845	15.1	
	22				98.6	0.977	101	532	0.98	543	
	23				122	0.977	125	1000	0.98	1020	
	26				64.8	0.977	66.3	66.2	0.977	67.8	
	27				261	0.977	267	553	0.98	564	
AHE62	A1	Malathion	1.0	0.3	79.0	0.958	82.5	45.9	0.746	61.5	
	A2				10.8	0.746	14.5	7.4	0.746	9.9	
	A3				15.6	0.746	20.9	11.6	0.746	15.5	
AHE63	A1	Carbaryl	1.0	0.3	31.5	0.912	34.5	115	0.834	138	
	A2				44.9	0.912	49.2	48.5	0.912	53.2	
	A3				36.5	0.912	40.0	70.9	0.834	85.0	
	A4				2.1	0.912	2.3	1.8	0.912	2.0	
	A5				12.4	0.912	13.6	4.8	0.912	5.3	
AHE64	A1	Carbaryl	1.0	0.3	63.7	0.899	70.9	460	0.899	512	
	A2				261	0.899	290	466	0.899	518	
	A3				38.3	0.843	45.4	65.2	0.899	72.5	
	A4				7023	0.992	7080	50233	0.992	50638	
	A5				< LOQ	--	0.5	< LOQ	--	0.50	

[a] When < LOQ or < LOD is reported, ½ LOQ or ½ LOD is used. Note no LOD was derived for AHE07 for any sampling matrix.
[b] Calculated from chromatogram peak response (e.g., ug/mL)
[c] FFAF=field fortification adjustment factor. From Supplemental Tables S – 11a-b.
[d] Adjusted Exposure = Raw exposure ÷ Field Fortification Adjustment Factor

Table S - 26. Head Patch (Inner and Outer): Field Sample Results											
Study ID	MU ID	Active Ingredient	Analytical Method Levels (ug/sample)[a]		Inner Head Patch			Outer Head Patch			
			LOQ	LOD	Raw Exp.[b]	FFAF[c]	Adj. Exp. (ug)[d]	Raw Exp.[b]	FFAF[c]	Adj. Exp. (ug)[d]	
AHE07	1	Carbaryl	0.25	--	1.3	0.837	1.6	636	0.869	732	
	3				2.3	0.837	2.7	3750	1.017	3687	
	4				0.133	1	0.133	234	0.869	269	
	6				0.41	0.837	0.49	1340	0.869	1542	
	8				8.2	0.837	9.8	6730	1.017	6618	
	10				0.133	1	0.133	993	0.869	1143	
	12				0.3	0.837	0.36	498	0.869	573	
	13				0.64	0.837	0.76	4360	1.017	4287	
	15				0.96	0.837	1.1	2130	0.869	2451	
	16				1.3	0.837	1.6	1330	0.869	1530	
	17				0.133	1	0.133	271	0.869	312	
	22				1.3	0.837	1.6	1460	0.869	1680	
	23				48.6	0.837	58.1	1770	0.869	2037	
	26				0.38	0.837	0.45	677	0.869	779	
	27				0.59	0.837	0.70	7520	1.017	7394	
AHE62	A1	Malathion	0.25	0.075	6.00	1.01	5.90	354	1.06	334	
	A2				0.60	1.01	0.59	94.5	1.06	89.2	
	A3				0.98	1.010	0.97	236	1.06	223	
AHE63	A1	Carbaryl	0.25	0.075	9.3	0.692	13.4	5498	0.971	5662	
	A2				2.0	0.692	2.9	1454	0.544	2673	
	A3				2.6	0.692	3.8	2253	0.544	4142	
	A4				< LOQ	--	0.13	10.4	0.544	19.1	
	A5				< LOD	--	0.04	71.6	0.544	132	
AHE64	A1	Carbaryl	0.25	0.075	0.89	0.81	1.1	1095	0.796	1376	
	A2				1.1	0.81	1.4	5836	0.952	6130	
	A3				0.39	0.81	0.48	139	0.796	175	
	A4				0.43	0.81	0.53	12452	0.952	13080	
	A5				< LOD	NA	0.04	0.58	0.796	0.73	

[a] When < LOQ or < LOD is reported, ½ LOQ or ½ LOD is used. Note no LOD was derived for AHE07 for any sampling matrix.
[b] Calculated from chromatogram peak response (e.g., ug/mL)
[c] FFAF=field fortification adjustment factor. From Supplemental Tables S – 15-16a-b.
[d] Adjusted Exposure = Raw exposure ÷ Field Fortification Adjustment Factor

Table S - 27. Face/Neck Wipe Field Sample Results									
Study ID	MU ID	Active Ingredient	Analytical Method Levels (ug/sample)[a]		Raw Exposure (ug)[b]	Face/Neck Exposure Adjustments			
						Field Fortification Adjustment Factor[c]	PPE Adjustment Factor[d]	Adjusted Exposure (ug)[e]	
			LOQ	LOD				Non-MEA	MEA[f]
AHE07	1	Carbaryl	1.0	--	76.7	0.955	1.0	80.3	161
	3				155	0.955	1.0	162	324
	4				28.2	0.849	1.0	33.2	66.4
	6				88.6	0.955	1.0	92.8	186
	8				913	0.955	1.0	956	1912
	10				51.7	0.849	1.0	60.9	122
	12				47.7	0.849	1.0	56.2	112
	13				45.2	0.849	1.0	53.2	106
	15				281	0.955	1.0	294	588
	16				43.3	0.849	1.0	51.0	102
	17				13.1	0.849	1.0	15.4	30.8
	22				325	0.955	1.0	340	680
	23				493	0.955	1.0	516	1032
	26				498	0.955	1.0	521	1042
	27				2420	0.955	1.0	2534	5068
AHE62	A1	Malathion	1.0	0.3	12.04	1.02	1.1	13	26.0
	A2				56.2	0.928	1.1	66.7	133
	A3				75.6	0.928	1.1	89.7	179
AHE63	A1	Carbaryl	1.0	0.3	518	0.899	1.0	576	1152
	A2				37.9	0.983	1.2	46.3	92.6
	A3				114	0.899	1.0	127	254
	A4				3.2	0.983	1.0	3.3	6.6
	A5				41.2	0.983	1.0	41.9	83.8
AHE64	A1	Carbaryl	1.0	0.3	221	0.847	1.0	261	522
	A2				3133	0.917	1.0	3417	6834
	A3				42.6	0.878	1.2	58.2	116
	A4				2689	0.917	1.0	2932	5864
	A5				40.8	0.878	1.2	55.8	112

[a] When < LOQ or < LOD is reported, ½ LOQ or ½ LOD is used. Note no LOD was derived for AHE07 for any sampling matrix.
[b] Calculated from chromatogram peak response (e.g., ug/mL)
[c] From Supplemental Tables – 12a-b.
[d] PPE characterized in Supplemental Table S – 5. PPE Adjustment Factors discussed in Section 3.2.2.
[e] Adjusted Exposure = Raw Exposure ÷ FF Adjustment Factor * PPE Adjustment Factor

[f] MEA = method efficiency adjustment. Data reflects a 2X adjustment to account for potential residue collection method inefficiencies. See Section 3.3.3 for more details. Only utilized for total dermal exposure with chemical-resistant hats (i.e., this adjustment is not applicable to exposure estimates without CR hats).

Table S - 28. Hand Wash Field Sample Results

Study ID	MU ID	Active Ingredient	Analytical Method Levels (ug/sample)[a]		Hand Wash Sample[b]								Total (ug)[e]	
					# 1		# 2		# 3		#4			
			LOQ	LOD	Raw Exp. (ug)[c]	FFAF[d]	Raw Exp. (ug)[c]	FFAF[d]	Raw Exp. (ug)[c]	FFAF[d]	Raw Exp. (ug)[c]	FFAF[d]	Non-MEA	MEA[f]
AHE07	1	Carbaryl	1.0	--	79.8	0.966	145	0.966	185	0.966	--	--	424	848
	3				1080	0.966	347	0.966	361	0.966	--	--	1851	3702
	4				21.7	0.966	114	0.966	37.6	0.966	--	--	179	358
	6				6.55	0.966	12.2	0.966	20.0	0.966	171	0.966	217	434
	8				781	0.966	640	0.966	484	0.966	2100	0.966	4146	8292
	10				86.7	0.966	179	0.966	--	--	--	--	275	550
	12				4.29	0.997	46.9	0.997	--	--	--	--	51.4	103
	13				64.4	0.966	132	0.966	--	--	--	--	203	406
	15				16.8	0.966	138	0.966	--	--	--	--	160	320
	16				109	0.966	267	0.966	--	--	--	--	389	778
	17				6.62	0.997	4.76	0.997	--	--	--	--	11.4	22.8
	22				663	0.966	893	0.966	--	--	--	--	1614	3228
	23				847	0.966	--	--	--	--	--	--	877	1754
	26				811	0.966	--	--	--	--	--	--	840	1680
	27				578	0.966	253	0.966	1940	0.966	--	--	2869	5738
AHE62	A1	Malathion	1.0	0.3	46.8	0.984	207.6	0.933	--	--	--	--	271	542
	A2				14.8	0.984	--		--	--	--		15.0	30.0
	A3				3.3	0.984	10.2	0.984	--	--	--	--	13.8	27.6
AHE63	A1	Carbaryl	1.0	0.3	52.2	1.11	215	1.10	--	--	--	--	242	484
	A2				247	1.10	--		--	--	--		225	450
	A3				64.8	1.10	--		--	--	--		58.9	118
	A4				5.9	1.11	12	1.11	--	--	--	--	16.1	32.2
	A5				33.2	1.11	--		--	--	--		29.9	59.8
AHE64	A1	Carbaryl	1.0	0.3	168	1.03	333	1.03	--	--	--	--	486	972
	A2				1152	1.12	--	--	--	--	--	--	1029	2058
	A3				428	1.03	--		--	--	--		416	832
	A4				1546	1.12	--	--	--	--	--	--	1380	2760
	A5				< LOQ	--	--		--	--	--		0.5	1.0

[a] When < LOQ or < LOD is reported, ½ LOQ or ½ LOD is used. Note no LOD was derived for AHE07 for any sampling matrix.
[b] Hand washes were conducted prior to lunch or bathroom breaks and at the end of the day.
[c] Calculated from chromatogram peak response (e.g., ug/mL)
[d] FFAF = field fortification adjustment factor. From Supplemental Tables S-13a-b.

[e] Total Hand Exposure = [Hand Wash #1 ÷ FF Adjustment Factor] + [Hand Wash #2 ÷ FF Adjustment Factor] …+ [Hand Wash #N ÷ FF Adjustment Factor]
[f] MEA = method efficiency adjustment. Data reflects a 2X adjustment to account for potential residue collection method inefficiencies. See Section 3.3.4 for more details. Only utilized for total dermal exposure with chemical-resistant hats (i.e., this adjustment is not applicable to exposure estimates without CR hats).

Table S - 29. Socks (AHE07 only): Field Sample Results							
Study ID	**MU ID**	**Active Ingredient**	**Analytical Method Levels (ug/sample)[a]**		**Socks**		
			LOQ	**LOD**	**Raw Exp.[b]**	**FFAF[c]**	**Adj. Exp. (ug)[d]**
AHE07	1	Carbaryl	0.25	--	1.5	0.692	2.2
	3				1.2	0.692	1.7
	4				0.27	0.692	0.39
	6				0.59	0.692	0.85
	8				16.1	0.692	23.3
	10				0.64	0.692	0.92
	12				0.55	0.692	0.79
	13				0.41	0.692	0.59
	15				4.6	0.692	6.6
	16				5.8	0.692	8.4
	17				0.67	0.692	0.97
	22				0.81	0.692	1.2
	23				4.8	0.692	6.9
	26				5	0.692	7.2
	27				83.7	0.775	108

[a] When < LOQ or < LOD is reported, ½ LOQ or ½ LOD is used. Note no LOD was derived for AHE07 for any sampling matrix.
[b] Calculated from chromatogram peak response (e.g., ug/mL)
[c] FFAF=field fortification adjustment factor. From Supplemental Table S – 17.
[d] Adjusted Exposure = Raw exposure ÷ Field Fortification Adjustment Factor

Table S - 30. Head Exposure with and without Chemical-Resistant Hats (Face/Neck Wipes plus Inner and Outer Head Patches)										
Study ID	MU ID	Face/Neck Wipe (ug)[a]		Head Patch				Total Head Exposure (ug)		
				Inner (ug)		Outer (ug)		w/o CR Hat[e]	With CR Hat[f]	
		Non-MEA	MEA	Adj. Exp.[b]	Extrapolated to Non-wiped Head Areas[c]	Adj. Exp. [b]	Extrapolated to Non-wiped Head Areas[d]		Non-MEA	MEA
AHE07	1	80.3	161	1.6	9.58	732	8769	8859	89.9	170
	3	162	324	2.7	16.17	3687	44170	44348	178	340
	4	33.2	66.4	0.133	0.75	269	3223	3257	33.9	67.1
	6	92.8	186	0.49	2.94	1542	18473	18569	95.7	189
	8	956	1912	9.8	58.70	6618	79284	80298	1015	1971
	10	60.9	122	0.133	0.75	1143	13693	13755	61.6	123
	12	56.2	112	0.36	2.16	573	6865	6923	58.4	115
	13	53.2	106	0.76	4.55	4287	51358	51416	57.8	111
	15	294	588	1.1	6.59	2451	29363	29664	301	595
	16	51.0	102	1.6	9.58	1530	18329	18390	60.6	112
	17	15.4	30.8	0.133	0.75	312	3738	3754	16.1	31.5
	22	340	680	1.6	9.58	1680	20126	20476	350	690
	23	516	1032	58.1	348.02	2037	24403	25267	864	1380
	26	521	1042	0.45	2.70	779	9332	9856	524	1045
	27	2534	5068	0.70	4.19	7394	88580	91118	2538	5072
AHE62	A1	13	26.0	5.90	35.34	334	4001	4050	48.3	61.3
	A2	66.7	133	0.59	3.53	89.2	1069	1139	70.2	137
	A3	89.7	179	0.97	5.81	223	2672	2767	95.5	185
AHE63	A1	576	1152	13.4	80.27	5662	67831	68487	656	1232
	A2	46.3	92.6	2.9	17.37	2673	32023	32086	63.7	110
	A3	127	254	3.8	22.76	4142	49621	49771	150	277
	A4	3.3	6.6	0.13	0.78	19.1	229	233	4.1	7.4
	A5	41.9	83.8	0.04	0.24	132	1581	1623	42.1	84.0
AHE64	A1	261	522	1.1	6.59	1376	16484	16752	268	529
	A2	3417	6834	1.4	8.39	6130	73437	76863	3425	6842
	A3	58.2	116	0.48	2.88	175	2097	2158	61.1	119
	A4	2932	5864	0.53	3.17	13080	156698	159634	2935	5867
	A5	55.8	112	0.04	0.24	0.73	9	64.8	56.0	112

[a] Face/neck wipe sample results from Supplemental Table S – 20.
[b] Head patch exposures from Supplemental Table S – 19.
[c] Inner head patch extrapolated to areas of the head not wiped using the Face/Neck wipe by adjusting the estimated surface area of the head not wiped by the

Face/Neck wipe (599 cm2) and the surface area of the inner head patch (100 cm^2), as follows: Inner Head Patch value (ug) * (599 cm^2/100 cm^2).
[d] Outer head patch extrapolated to areas of the head not wiped using the Face/Neck wipe by adjusting the estimated surface area of the head not wiped by the Face/Neck wipe (599 cm2) and the surface area of the outer head patch (50 cm^2), as follows: Outer Head Patch value (ug) * (599 cm^2/50 cm^2).
[e] Head Exposure without CR Hats (ug) = Face/Neck Wipe (µg) + Extrapolated Inner Head Patch (ug) + Extrapolated Outer Head Patch (ug). Note only "Non-MEA" face/neck wipe values are used for this estimate.
[f] Head Exposure with CR Hats (ug) = Face/Neck Wipe (µg) + Extrapolated Inner Head Patch (ug).

Table S - 31. Total Dermal Exposures																	
Study ID	MU ID	BW (kg)	Body[a] (µg)							Hand[b] (µg)		Head[c] (µg)		Feet[d] (ug)	Total Exposure (µg)[e]		Total Exposure (µg/kg)[f]	
			LA	UA	FT	RT	LL	UL	Total	Non-MEA	MEA	with CR Hat	w/o CR Hat		with CR Hat	w/o CR Hat	with CR Hat	w/o CR Hat
AHE07	1	51	75.4	46.6	23.9	25.6	29.1	84.6	285	424	848	170	8859	2.2	1305	9570	25.59	187.65
	3	73	1255	172	360	156	31.7	191	2166	1851	3702	340	44348	1.7	6210	48367	85.07	662.56
	4	118	197	43.1	90.0	43.8	11.0	68.6	454	179	358	67.1	3257	0.39	879	3890	7.45	32.97
	6	68	355	131	161	103	11.8	51.7	814	217	434	189	18569	0.85	1438	19601	21.15	288.25
	8	64	908	243	426	276	112	542	2507	4146	8292	1971	80298	23.3	12793	86974	199.89	1358.97
	10	94	1415	1790	237	558	18.5	65.7	4084	275	550	123	13755	0.92	4758	18115	50.62	192.71
	12	93	235	99.3	99.9	59.9	14.8	49.3	558	51.4	103	115	6923	0.79	777	7533	8.35	81.00
	13	77	235	213	182	162	99.5	209	1101	203	406	111	51416	0.59	1619	52721	21.03	684.69
	15	67	726	673	718	376	51.8	333	2878	160	320	595	29664	6.6	3800	32709	56.72	488.19
	16	109	333	60.8	212	71.1	169	326	1172	389	778	112	18390	8.4	2070	19959	18.99	183.11
	17	89	53.1	25.1	37.3	15.1	14.8	15.1	161	11.4	22.8	31.5	3754	0.97	216	3927	2.43	44.12
	22	96	532	285	495	310	101	543	2266	1614	3228	690	20476	1.2	6185	24357	64.43	253.72
	23	127	1005	292	605	913	125	1020	3960	877	1754	1380	25267	6.9	7101	30111	55.91	237.09
	26	77	799	601	550	511	66.3	67.8	2595	840	1680	1045	9856	7.2	5327	13298	69.18	172.70
	27	99	5028	2888	3421	2684	267	564	14852	2869	5738	5072	91118	108	25770	108947	260.30	1100.47
AHE62	A1	73	33.9	28.0	59.2	23.2	82.5	61.5	288	271	542	61.3	4050	--	891	4609	12.21	63.14
	A2	83	69.6	60.5	67.3	57.3	14.5	9.9	279	15.0	30.0	137	1139	--	446	1433	5.37	17.27
	A3	89	86.3	16.1	82.2	18.1	20.9	15.5	239	13.8	27.6	185	2767	--	452	3020	5.08	33.93
AHE63	A1	114	1230	1206	2251	502	34.5	138	5362	242	484	1232	68487	--	7078	74091	62.09	649.92
	A2	79	3480	1723	999	482	49.2	53.2	6786	225	450	110	32086	--	7346	39097	92.99	494.90
	A3	83	293	53.2	183	96	40.0	85.0	750	58.9	118	277	49771	--	1145	50580	13.80	609.40
	A4	92	5.0	3.0	2.4	6.0	2.3	2.0	20.7	16.1	32.2	7.4	233	--	60.3	270	0.66	2.93
	A5	89	44.0	48.7	54.1	25.2	13.6	5.3	191	29.9	59.8	84.0	1623	--	335	1844	3.76	20.72
AHE64	A1	90	1158	246	475	311	70.9	512	2773	486	972	529	16752	--	4274	20011	47.49	222.34
	A2	75	5147	3408	3559	3671	290	518	16593	1029	2058	6842	76863	--	25493	94485	339.91	1259.80
	A3	96	384	87.4	146	46.1	45.4	72.5	781	416	832	119	2158	--	1732	3355	18.04	34.95
	A4	92	5631	1660	1574	5492	7080	50638	72075	1380	2760	5867	159634	--	80702	233089	877.20	2533.58
	A5	86	2.0	0.50	0.50	0.50	0.5	0.50	4.5	0.5	1.0	112	64.8	--	118	69.8	1.37	0.81

[a] Dermal body exposures from Supplemental Tables S – 18a-c. LA = lower arm; UA = upper arm; FT = front torso; RT = rear torso; LL = lower leg; UL = upper leg. Total = LA + UA + FT + RT + LL + UL.
[b] Hand exposure from Supplemental Table S – 21.

[c] Head exposure from Supplemental Table S – 22. Note that MEA data presented for head exposure with CR hats.
[d] Feet exposure from Supplemental Table S – 23.
[e] Total Exposure (µg) = Total Body + Hands + Feet (AHE07 only) + Head. Note for exposure with CR hats, only estimates using MEA hand wash and face/neck wipe data are shown (see Section 3.4.1).
[f] Total Exposure (ug/kg) = Total Exposure (ug) ÷ Body Weight (kg). Note for exposure with CR hats, only estimates using MEA hand wash and face/neck wipe data are shown. (see Section 3.4.1).

Table S - 32. OVS Air Sample Field Results and Inhalation Exposure																
Study ID	MU ID	BW (kg)	Active Ingredient	Analytical Method Levels (ug/sample)[a]		Measured Residue						Inhalation Exposure			
						Front Section			Back Section			Breath Rate (LPM)	Pump Rate (LPM)	Total	
				LOQ	LOD	Raw Exp. (ug)[b]	FFAF[c]	Adj. Exp.[d]	Raw Exp. (ug)[b]	FFAF[c]	Adj. Exp.[d]			(ug)[e]	(ug/kg)[e]
AHE07[f]	1	51	Carbaryl	0.01	--	4.1	1.094	3.7	NA			8.3	2.00	15.4	0.302
	3	73				14.2	1.094	13.0	NA			8.3	2.00	54.0	0.740
	4	118				4.9	1.094	4.5	NA			8.3	2.00	18.7	0.158
	6	68				13	1.094	11.9	NA			8.3	2.05	48.2	0.709
	8	64				73.9	1.012	73.0	NA			8.3	2.05	296	4.625
	10	94				9.5	1.094	8.7	NA			8.3	2.10	34.4	0.366
	12	93				11.7	1.094	10.7	NA			8.3	2.10	42.3	0.455
	13	77				10.6	1.094	9.7	NA			8.3	2.05	39.3	0.510
	15	67				9.5	1.094	8.7	NA			8.3	2.05	35.2	0.525
	16	109				8.6	1.094	7.9	NA			8.3	2.05	32.0	0.294
	17	89				5	1.094	4.6	NA			8.3	2.05	18.6	0.209
	22	96		0.05		13.5	1.094	12.3	NA			8.3	2.00	51.0	0.531
	23	127				9.3	1.094	8.5	NA			8.3	2.00	35.3	0.278
	26	77				8.2	1.094	7.5	NA			8.3	2.05	30.4	0.395
	27	99				129	1.012	127.5	NA			8.3	2.00	529	5.343
AHE62	A1	73	Malathion	0.01	0.0015	7.50	1.05	7.14	0.0208	1.18	0.0176	8.3	1.95	30.5	0.418
	A2	83				8.80	1.05	8.38	< LOD	--	0.00075	8.3	1.95	35.7	0.430
	A3	89				10.66	1.05	10.15	< LOD	--	0.00075	8.3	1.90	44.3	0.498
AHE63	A1	114	Carbaryl	0.005	0.0015	28.45	0.990	28.74	< LOD	--	0.00075	8.3	2.04	117	1.026
	A2	79				5.23	0.990	5.28	< LOD	--	0.00075	8.3	2.01	21.8	0.276
	A3	83				16.36	0.990	16.53	< LOD	--	0.00075	8.3	2.03	67.6	0.814
	A4	92				0.78	0.990	0.79	< LOD	--	0.00075	8.3	2.01	3.25	0.035
	A5	89				7.31	0.990	7.38	< LOQ	--	0.00250	8.3	2.02	30.3	0.340
AHE64	A1	90	Carbaryl	0.005	0.0015	10.81	1.04	10.39	< LOQ	--	0.00250	8.3	2.02	42.7	0.474
	A2	75				3.72	1.04	3.58	< LOQ	--	0.00250	8.3	2.05	14.5	0.193
	A3	96				3.38	1.04	3.25	< LOD	--	0.00075	8.3	2.01	13.4	0.140
	A4	92				1.68	1.04	1.62	< LOD	--	0.00075	8.3	2.02	6.66	0.072
	A5	86				0.082	1.16	0.07	< LOD	--	0.00075	8.3	2.02	0.294	0.003

[a] When < LOQ or < LOD is reported, ½ LOQ or ½ LOD is used.
[b] Calculated from chromatogram peak response (e.g., ug/mL)
[c] FFAF = field fortification adjustment factor. From Supplemental Tables S – 14a-b.

[d] Adjusted Exposure = Raw Exposure ÷ FF Adjustment Factor
[e] Total Exposure = [Adjusted front section + Adjusted back section] * [Breathing Rate ÷ Pump Flow Rate]
[f] OVS sampler sections not analyzed separately. Results for "Front Section" represent a composite of the sections.

Table S - 33. Dermal and Inhalation Unit Exposures								
Study ID	MU ID	AaiH	Dermal Exposure				Inhalation Exposure	
			Total (µg)[a]		Unit Exposure (ug/lb ai)[b]		Total (ug)[c]	Unit Exposure (ug/lb ai)[b]
			with CR Hat[d]	w/o CR Hat	with CR Hat[d]	w/o CR Hat		
AHE07	1	75	1305	9570	17.4	128	15.4	0.205
	3	45	6210	48367	138	1075	54.0	1.20
	4	75	879	3890	11.7	51.9	18.7	0.249
	6	60	1438	19601	24.0	327	48.2	0.803
	8	52	12793	86974	246	1673	296	5.68
	10	32	4758	18115	149	566	34.4	1.07
	12	33	777	7533	23.5	228	42.3	1.28
	13	36	1619	52721	45.0	1464	39.3	1.09
	15	24	3800	32709	158	1363	35.2	1.47
	16	40	2070	19959	51.8	499	32.0	0.800
	17	34	216	3927	6.4	116	18.6	0.548
	22	60	6185	24357	103	406	51.0	0.851
	23	90	7101	30111	78.9	335	35.3	0.392
	26	90	5327	13298	59.2	148	30.4	0.337
	27	90	25770	108947	286	1211	529	5.88
AHE62	A1	34.3	891	4609	26.0	134	30.5	0.889
	A2	5.0	446	1433	89.2	287	35.7	7.13
	A3	10.4	452	3020	43.5	290	44.3	4.26
AHE63	A1	48.4	7078	74091	146	1531	117	2.42
	A2	35.6	7346	39097	206	1098	21.8	0.612
	A3	24.4	1145	50580	46.9	2073	67.6	2.77
	A4	15.2	60.3	270	4.0	17.8	3.25	0.214
	A5	6.1	335	1844	54.9	302	30.3	4.97
AHE64	A1	63.1	4274	20011	67.7	317	42.7	0.677
	A2	10.1	25493	94485	2524	9355	14.5	1.44
	A3	35.3	1732	3355	49.1	95.0	13.4	0.380
	A4	25.2	80702	233089	3202	9250	6.66	0.264
	A5	18.2	118	69.8	6.5	3.8	0.294	0.00026

[a] See Supplemental Tables S – 24.
[b] Unit Exposure (µg/lb ai) = Exposure (µg) ÷ AaiH (lbs).
[c] See Supplemental Tables S – 25.
[d] Dermal exposure with CR hats reflects MEA hand wash and face/neck wipe data.

Table S - 34. Protocol Amendments and Deviations			
Study ID	**Summary of Amendments**	**Summary of Deviations**	
		Field Phase	**Analytical Phase**
AHE62	Amended once to incorporate comments from EPA, California Department of Pesticide Regulation, and HSRB. **Protocol Amendment 1** • Inclusion criteria amended to allow participation of workers who normally wear two layers of clothing. • Recruitment area expanded to allow any county in CA or WA. • Removed efficient configuration requirement if recruitment area is expanded. **Protocol Amendment 2** • Added a new malathion product to possible test products (the active ingredient malathion was already an approved surrogate) **Protocol Amendment 3** • Specified the analytical methods to be used for head patches	Reported: 1. On study day 1, inner and outer head patch field fortifications were conducted in duplicate instead of triplicate, and on study day 1, no samples were taken for the higher fortification level (100 ug) for the inner head patches. Unreported: 1. Subject A2 was monitored for 174 minutes, although the protocol requires a minimum 4-hour period.	1. Field fortification solutions for some lots were not verified to establish concentration.
AHE63	Amended once to incorporate comments from EPA and HSRB. **Protocol Amendment 1** • Recruitment process modified to permit use of recruitment letters • Reduce heat index triggering stopping rule lowered from 120° F to 105° F • Amend dermal exposure sampling procedure to specify that the inner dosimeters would be cut into 6 sections rather than 2 sections • Revise analytical methods to make them appropriate for dosimeters sectioned into 6 pieces • Amend protocol to clarify the AHETF's raw data retention policy **Protocol Amendment 2** • Amended analytical method for head patches	Reported: 1. Subject A5 applied only 2 tank loads and sprayed for only 2 hours, although the protocol specifies that each subject should apply a minimum of 3 tank loads over a minimum time of 4 hours; also, the highest stratum (56 to 100 lbs a.i.) was not achieved; the highest amount sprayed was 48 lbs a.i Unreported: 1. None	1. The analytical laboratory deviated from methodologies related to analysis of carbaryl in inner dosimeters 2. The analytical lab deviated from methodologies related to analysis of carbaryl in face/neck wipe samples
AHE64	Amended once to incorporate comments from EPA and HSRB. **Protocol Amendment 1** • Recruitment process modified to permit use of recruitment letters • Recruitment area expanded to allow counties adjacent to Tulsa County, Oklahoma.	Reported: 1. Subjects A2, A3, A4, A5 each applied only 2 tank loads and sprayed for less than 4 hours, although the protocol specifies that each subject should apply a	1. The analytical laboratory deviated from analytical methodologies related to analysis of carbaryl in inner dosimeters.

Table S - 34. Protocol Amendments and Deviations			
Study ID	**Summary of Amendments**	**Summary of Deviations**	
		Field Phase	**Analytical Phase**
	• Removed efficient configuration requirement if recruitment area is expanded. • Amended dermal exposure sampling procedure to specify that the inner dosimeters would be cut into 6 sections • Revise analytical methods to make them appropriate for dosimeters cut in 6 sections	minimum of 3 tank loads over a minimum time of 4 hours. Also, the lowest stratum (5 to 9 lbs a.i.) was not achieved; the lowest amount sprayed was 10 lbs a.i.	
	Protocol Amendment 2 The study director was changed from Eric D. Bruce to Larry D. Smith, effective September 14, 2009 (after study closure)	Unreported: 1. None	