REPORT TITLE

Passive Dosimetry Data Derived from the Outdoor Residential Exposure Task Force and Pesticide Handler Exposure Databases - Comparisons to Biomonitoring Data

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SUBMITTED BY

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EXECUTIVE SUMMARY

Passive dosimetry (PD) data from the Outdoor Residential Exposure Task Force (ORETF) and the Pesticide Handlers Exposure Database (PHED) were compared to biomonitoring (BM) data from analogous exposure scenarios which were specifically discussed in the paper by Ross et al., 2006. The objective of these comparisons was to calculate the ratio of the PD data from ORETF and PHED to the BM data from the Ross paper (PD/BM ratio) in those cases where comparable scenarios exist. The comparison provides insight into the reliability of generically-generated PD data to predict actual exposures, i.e., exposures more accurately determined by BM.

Twelve exposure scenarios were compared in this assessment. The range of the PD/BM ratios calculated is in good agreement with the range of ratios calculated for the concurrent PD/BM studies in the Ross et al. paper. The PD/BM ratios generally fall close to a value of 1.0 for both the concurrent PD/BM data in Ross et al. and for the PD/BM data using the generic PD data from ORETF and PHED examined in this assessment. It is interesting that the comparison of PD data from the ORETF and PHED database, independent in respect to time, methodology, site, etc., could provide ratios so similar to those of the PD data obtained concurrently with the BM data from studies described in Ross et al. The median PD/BM ratio is 1.3 and the geometric mean ratio is 1.5 with a 95% confidence interval of 0.7 to 3.0. Thus, the GM ratio is not significantly different from 1.0. Also, the correlation between the logarithms of PD and BM absorbed doses is 0.91 ($p<0.0001$). The values appear to vary on both sides of the PD=BM line, with perhaps a slight tendency for the PD absorbed dose to be greater. This GM ratio is very similar to the PD/BM ratio of 1.18 found by Ross et al. (2006) for concurrent comparisons. Overall, it is concluded that exposure estimates derived from generic passive dosimetry studies provide a reasonable estimate of exposure, as confirmed by comparison to biomonitoring data for analogous scenarios.

BACKGROUND

A comparison of ORETF and PHED data was made to scenarios for which biomonitoring data exist as discussed in the paper by Ross et al., 2006. For this assessment, mean values have been used for the comparisons and the various assumptions required for each of the comparisons have been outlined in this document and/or in the calculation tables. Comparisons were made where the description of required data, e.g., amount of active ingredient handled, equipment used, formulation type, etc., was available. It should be noted that in this paper the term "concurrent" is used when referring to the passive dosimetry collected in the same study as biomonitoring data with the same individuals participating in both methods of exposure assessment. In the paper by Ross et al. (2006) the term is used slightly differently: "concurrent" is used when the passive dosimetry matrices are worn by the person at the exact same time that the biomonitoring aspect is being conducted, and "sequential" is used when the two methodologies are employed in the same individuals but at separate times.

DESCRIPTIONS OF STUDY COMPARISONS

ORETF Data Comparison to Biomonitoring Scenarios

Data generated by the ORETF for the treatment of lawns by homeowners with hose-end sprayers can be compared to scenarios (Rosenheck 2000) from the BM paper of Ross et al., 2006. The Rosenheck (2000) study also included homeowners who made applications with hand pump (Hudson) sprayers to house perimeters, spot treatments on lawns, ornamentals, and shrubs. While there were no data generated by ORETF that allowed for a direct comparison to these application sites, the use of hand pump sprayers on garden vegetables was a scenario for which data were generated and considered to be quite comparable. The descriptions of those studies follow.

Rosenheck, 2000 – Treatment of Lawns

The following description of the Rosenheck, 2000 biomonitoring study was taken directly from the biomonitoring paper by Ross et al., 2006.

Hose-End Sprayers and Hudson Sprayer (Rosenheck, 2000)

Three methods of application frequently used by homeowners were monitored:

- Hose-end sprayer with a ready-to-use (RTU) formulation (Comparison #1); 11 handlers.
- Hose-end sprayer (dial type) with an emulsifiable concentrate (EC) formulation (Comparison #2); 12 handlers.
- Hudson pump-up type hand sprayer with wand (Comparison #3); 10 handlers.

Each person using the hose-end sprayers applied 0.5 pounds of active ingredient (Lb AI) in a 946-mL container to approximately 5,000 square feet of turf. Hudson sprayer users mixed, loaded, and applied 0.021 Lb AI of an EC formulation to house perimeters, spot lawn treatments, ornamentals, and shrubs. All volunteers wore a t-shirt, shorts, socks, and shoes. The replicate duration was 18–122 minutes, depending on the method of application. Urine was collected for one day before and four days after use. Passive dosimetry methods utilized cotton long johns (i.e., long underwear) worn under a short-sleeve shirt and pants, plus the use of face wipes and hand washes.

ORETF, 2002 - Treatment of Lawns and Vegetable Gardens

The following description of the ORETF data was taken from the ORETF report by Klonne, 2002 [Klonne, D.R. Summary of Exposure Data for all Mixer/Loader/Applicator Studies Conducted or Purchased by the ORETF: Professional Lawn Care Operators Applying Pesticides to Residential Turf and Homeowners Applying Pesticides to Residential Turf, Home Gardens, and Ornamental Plants, February 4, 2002, MRID 45663701].

Potential exposure was assessed using whole body dosimetry, hand washes (0.01% Aerosol® OT [AOT] solution) and face/neck wipes (AOT-moistened gauze pads) for dermal exposure. Potential respiratory exposure was assessed with a personal low-volume air sampling pump with an appropriate sample sorbent preceded by a glass-fiber filter and contained in an OSHA Versatile Sampler tube. Both outer (long pants and long-sleeved shirt) and inner (long underwear) dosimeters were cut into 6 sections (upper and lower arm, upper and lower leg, and front and rear torso) to evaluate deposition to specific body parts. These data were used in conjunction with hand washes and face/neck wipes to determine the total exposure. For comparisons to the biomonitoring data of Rosenheck (2000), the t-shirt and shorts clothing scenario data were used.

The application equipment used in all the studies was selected because it is commonly used by the homeowner and it is also readily available in retail stores. More detailed descriptions of each study are contained in the following sections.

Lawn Treatments

For these studies the homeowners (n=30) used a Ready-To-Use (RTU) Bug-B-Gone hose-end sprayer (Comparison #1) or an Ortho Dial' n-Spray dial-type hose-end sprayer (DTS) (Comparison #2). Each participant applied 0.5 lbs AI to lawns.

Garden Treatments

For these studies the homeowners (n=20) used a hand-held pump-up sprayer with a 2-gallon capacity (Comparison #3). The participants applied 1 container with 0.017 lbs AI to a garden with cucumber and tomato plants. This was deemed to be an application pattern that was close to the study by Rosenheck (2000) in which those participants made applications with a hand-held pump-up sprayer to house perimeters, spot treatments on lawns, ornamentals, and shrubs.

PHED Data Comparison to Biomonitoring Scenarios

Complete descriptions of the biomonitoring studies are contained in the paper by Ross et al. (2006). Only the details necessary to understand the comparison to PHED are related here. The PHED data are derived from the PHED Surrogate Exposure Guide Estimates of Worker Exposure from The Pesticide Handler Exposure Database Version 1.1, August 1998. Appendix 1 contains copies of the summary data sheets from the PHED Surrogate Exposure Guide for each of the scenarios used in these comparisons.

Honeycutt & Day, 1994 (Biomonitoring scenario from Ross et al., 2006)

This concurrent PD/BM study monitored liquid airblast applications to orchards with open cab tractors (Comparison #5) and mixing/loading for those applications (Comparison #4). Clothing included coveralls over short-sleeved shirts and long pants (SS & LP), helmets,

respirators, goggles, and chemical-resistant (CR) gloves. The assumed inhalation rate was 16.7 LPM. There was an average of 74 pounds of AI handled by both mixer/loaders and applicators.

The PHED scenario for comparison to the open pour liquid formulation mixing/loading is Scenario 3. The clothing scenario used for comparison was a single layer with gloves but with the body residue value decreased by ½ for a second layer of clothing as recommended in the PHED document (1998).

The PHED scenario for comparison to the open cab airblast applicator is Scenario 11. The clothing scenario used for comparison was a single layer with gloves but with the body residue value decreased by ½ for a second layer of clothing.

Knuteson et al., 1999 (Biomonitoring scenario from Ross et al., 2006)

This study included mixing/loading of a liquid formulation (Comparison #6). Clothing included coveralls over underwear, caps, goggles, gloves, and an apron. The assumed inhalation rate was 16.7 LPM. There was an average of 430 pounds of AI handled.

The PHED scenario for comparison to the open pour liquid formulation mixing/loading is Scenario 3. The clothing scenario used for comparison was a single layer with gloves.

Shurdut et al., 1993 (Biomonitoring scenario from Ross et al., 2006)

This study included application of sprays to crops using open cab tractors (Comparison #7). Clothing included coveralls over underwear, socks, baseball cap, goggles and chemical-resistant boots. The assumed inhalation rate was 16.7 LPM. There was an average of 58 pounds of AI handled.

The PHED scenario for comparison to the open cab groundboom application of sprays is Scenario 13. The clothing scenario used for comparison was a single layer without gloves.

Findlay, 1998 (Biomonitoring scenario from Ross et al., 2006)

This study monitored M/L/A using hand-held backpack sprayers (Comparison #8). Clothing included long-sleeved shirts (LS) & LP with gloves and a faceshield generally being worn during M/L. The assumed inhalation rate was 16.7 LPM. There was an average of 0.74 pounds of AI handled.

The PHED scenario for comparison to the open pour mixing/loading of a liquid formulation and application of sprays via a backpack is Scenario 34. There was only one clothing scenario available in PHED for comparison and that was a single layer with gloves. Since gloves were worn in the BM study only during M/L, the PHED value that is being used in this comparison may significantly underestimate the dermal dosage, thus reducing the calculated ratio for the passive dosimetry/biomonitoring.

Chester and Hart, 1986 (Biomonitoring scenario from Ross et al., 2006)

This study included M/L/A using an open pour liquid formulation then application of sprays via groundboom equipment with closed cab tractors (Comparison #9). Clothing included pants and short-sleeved shirt, with a jacket sometimes being worn. Cotton gloves and a faceshield were worn during M/L. Inhalation exposure was not measured because it was considered to be negligible. There was an average of 132 pounds of AI handled.

The PHED scenario for comparison to the open pour mixing/loading of a liquid formulation and application of sprays via closed cab groundboom application is Scenario 29. The clothing scenario used for comparison was a single layer with gloves. It should be noted that, since workers in the biomonitoring study wore short sleeved shirts, this may produce a lower PD/BM ratio calculation than if long sleeves had been worn (assuming increased deposition of residue on the lower arm with a subsequent increase in absorption) since the PD value from PHED will assume long sleeved shirts.

Selman, 1996 (Biomonitoring scenario from Ross et al., 2006)

This study monitored workers making closed cab groundboom applications of sprays (Comparison #10) and M/L/A open pouring liquid formulations and making closed cab groundboom applications of sprays (Comparison #11). Clothing typically included LS & LP. The assumed inhalation rate was 16.7 LPM. There was an average of 357 pounds of AI handled by the applicators and 133 pounds of AI handled by the M/L/A.

The PHED scenario for comparison to the closed cab groundboom application of sprays is Scenario 14. The clothing scenario used for comparison was a single layer without gloves.

The PHED scenario for comparison to the open pouring of a liquid formulation followed by the closed cab groundboom application of sprays is Scenario 29. The clothing scenario used for comparison was a single layer without gloves.

Grover et al., 1986 (Biomonitoring scenario from Ross et al., 2006)

This study included M/L/A open pouring a liquid formulation and then applying sprays via groundboom equipment with closed cab tractors (Comparison #12). Clothing included two layers of cotton clothing. Inhalation exposure was not measured because it was considered to be negligible. There was an average of 176 lbs AI handled.

The PHED scenario for comparison to the open pouring of a liquid formulation followed by the closed cab groundboom application of sprays is Scenario 29. The clothing scenario used for comparison was a single layer without gloves but with the body residue value decreased by ½ for a second layer of clothing.

STATISTICAL METHODS AND CALCULATIONS

Some values reported in this summary report are based on rounded values for simpler presentation and therefore might be difficult to reconstruct exactly due to calculations performed on the rounded values. Calculations were performed with the routines available in Microsoft® Excel®, Office 2000 edition.

Appendix 2 contains the data used for comparisons and the calculations based on those data. Table 1 in Appendix 2 provides background information on all the studies used in the comparisons of passive dosimetry (PD) to biomonitoring (BM) data. Tables 2 and 3 of Appendix 2 provide calculations for the comparisons made in this paper. Table 4 of Appendix 2 provides a more succinct summary of data presented in Table 3. Table 4 of Appendix 2 is also reproduced in this text section as text Table 1. An explanation of the calculations used for the comparisons presented in this paper follows.

Biomonitoring Data Calculations

PD and BM data, presented in the paper by Ross et al., 2006, are presented as dosages (µg exposure/kg body weight [BW]). Those geometric mean values are adjusted for a standard BW of 70 kg to calculate the total dose, and are then normalized by the amount (lbs) of AI handled as shown in the following example:

Assume: PD Dermal Dosage value of 10 µg/kg; 5 lbs AI handled in the work activity

PD Normalized Dermal Dosage = (PD Dermal Dosage x 70 kg BW) / lbs AI handled
(µg exposure / lb AI handled) = (10 x 70) / 5
= 140 µg / lb AI

Similar calculations are performed for other values such as the inhalation dosage, total passive dosimetry dosage, and the biomonitoring dosage.

ORETF and PHED Data Calculations

1) Calculation of Adjusted Inhalation Rates

The biomonitoring data presented by Ross et al. (2006) were adjusted for a single inhalation rate of 16.7 LPM to be used in all the calculations of absorbed dose. The unit exposure data presented in the ORETF studies assumed an inhalation rate of 17 LPM, while those of PHED assumed a value of 29 LPM. It was therefore necessary for these comparisons to adjust these data to the same 16.7 LPM used in the calculations of the biomonitoring data. To do so only requires the calculation of the ratio of the different inhalation rates and subsequent adjustment of the original inhalation unit exposure value in the report by this ratio value. The adjustments for all the ORETF and PHED studies are presented in Table 2 of Appendix 2. Following is an example of an adjustment for PHED data:

Assume: Original Inhalation Unit Exposure Value (µg/lb AI) = 20; inhalation rate = 29 LPM

Ratio of inhalation rates = 16.7 LPM / 29 LPM = 0.6

Adjusted Normalized Inhalation Exposure (µg/lb AI) = 20 (µg/lb AI) x 0.6 = 12 µg/lb AI

2) Calculation of Estimated Absorbed Dosage from Passive Dosimetry

For the PD values from ORETF or PHED, the Dermally Deposited Residue (µg / lb AI) is adjusted by the Percent Dermal Absorption of the AI to which it is being compared to derive the PD Normalized Dermal Dosage (µg/lb AI). The values used from the ORETF studies are geometric mean values and the values from PHED are presumably arithmetic mean values as presented in the PHED Surrogate Exposure Guide (1998). An example calculation is shown below.

Assume: PD Dermally Deposited Residue value of 1000 µg/lb AI; % Dermal Absorption = 2%

PD Normalized Dermal Dosage = PD Dermally Deposited Residue x % Dermal Abs.
(µg exposure / lb AI handled) = 1000 x 0.02
= 20 µg / lb AI

The PD Normalized Dermal Dosage calculated above is added to the PD Normalized Inhalation Dosage (µg/lb AI) to derive the PD Normalized Estimated Absorbed Dosage (µg/lb AI). Note that no adjustment of the inhalation value is made because the absorption is assumed to be 100% for inhaled residue. Thus:

PD Normalized Estimated Absorbed Dosage (µg/lb AI) =
PD Normalized Dermal Dosage (µg/lb AI) + PD Normalized Inhalation Dosage (µg/lb AI)

PD/BM Ratio Calculation

The final calculation is the calculation of the ratio of the PD Normalized Estimated Absorbed Dosage (µg/lb AI) to the Normalized BM Dosage (µg/lb AI) as shown below:

$$\text{PD/BM ratio} = \frac{\text{PD Normalized Estimated Absorbed Dosage (µg/lb AI)}}{\text{Normalized BM Dosage (µg/lb AI)}}$$

The statistical analyses of the PD/BM ratio data and the construction of the regression plot was performed in Excel and followed the methods described in: Zar, J. H. 1999. Biostatistical Analysis, 4th Ed. Prentice Hall, New Jersey. 663 pp.

RESULTS

Table 1 presents a summary of the PD/BM ratios calculated by comparing the ORETF and PHED passive dosimetry data to the biomonitoring data of Ross et al., 2006. Data from 12 exposure scenarios were available for comparisons in this assessment. The dermal and inhalation data derived by PD measurements in the ORETF and PHED studies are comparable to the data derived from PD measurements collected in the concurrent biomonitoring studies (Table 1). The ratios of PD measurements from the ORETF and PHED studies to the dose determined from biomonitoring are also generally clustered around a value of 1.0 for the comparisons.

Figure 1 shows the relationship between the two estimates of absorbed dose for exposure scenarios common to both data sources (ORETF/PHED PD data versus BM data from the Ross paper). There is good agreement between the two methods even though the respective exposure scenarios common to each source involve different individuals. The correlation between the logarithms of PD and BM absorbed doses is 0.91 ($p<0.0001$). The values appear to vary on both sides of the PD=BM line, with perhaps a slight tendency for the PD absorbed dose to be greater.

The PD/BM ratios generally fall close to a value of 1.0 for both the concurrent PD/BM data in Ross et al. and for the PD/BM data using the generic PD data from ORETF and PHED examined in this assessment. It is interesting that the comparison of PD data from the ORETF and PHED database, independent in respect to time, methodology, site, etc., could provide ratios so similar to those of the PD data obtained concurrently with the BM data from studies described in Ross et al. The median PD/BM ratio from these comparisons is 1.3 and the geometric mean ratio is 1.5 with a 95% confidence interval of 0.7 to 3.0. Thus, the geometric mean ratio is not significantly different from 1.0. This GM ratio is also very similar to the PD/BM ratio of 1.18 found by Ross et al. (2006) for concurrent comparisons.

Overall, the conclusion is that exposure estimates derived from generic passive dosimetry studies provide a reasonable estimate of exposure, as confirmed by comparison to biomonitoring data for analogous scenarios. That is, standard passive dosimetry methodology consisting of either patches or whole body dosimeters to measure body exposure, hand rinses, hand washes, or cotton glove dosimeters to measure hand exposure, and face/neck wipes or head and neck patch extrapolation to measure head and face exposure is well correlated with the actual absorbed dose as determined by biomonitoring.

Table 1. SUMMARY TABLE FOR DATA PRESENTED IN APPENDIX 2 - NORMALIZED ORETF AND PHED DATA COMPARED TO DATA FROM BIOLOGICAL MONITORING STUDIES

		ORETF or PHED Data			Data from Biological Monitoring Study				
Reference	Scenario	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage	Passive Dosim. - Normalized Estimated Absorbed Dosage	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage	Passive Dosim. - Normalized Estimated Absorbed Dosage	Normalized Biomon Dosage	Ratio of ORETF or PHED PD/Biomon Dosage
		µg/lb AI Handled							
Comparison #1 ORETF 2002/ Rosenheck 2000	Hose-end Sprayer - Lawn	396	17	413	140	9.8	168	140	3.0
Comparison #2 ORETF 2002/ Rosenheck 2000	RTU Hose-end - Lawn		10	104	45	36	88	118	0.9
Comparison #3 ORETF 2002/ Rosenheck 2000	Hand Pump Sprayer - Lawn & Ornamentals	94 1375	5.2	1380	367	130	567	1333	1.0
Comparison #4 PHED/ Honeycutt 1994	Liquid Open Pour M/L	0.5	0.7	1.2	1.9	0.1	2.1	5.1	0.2

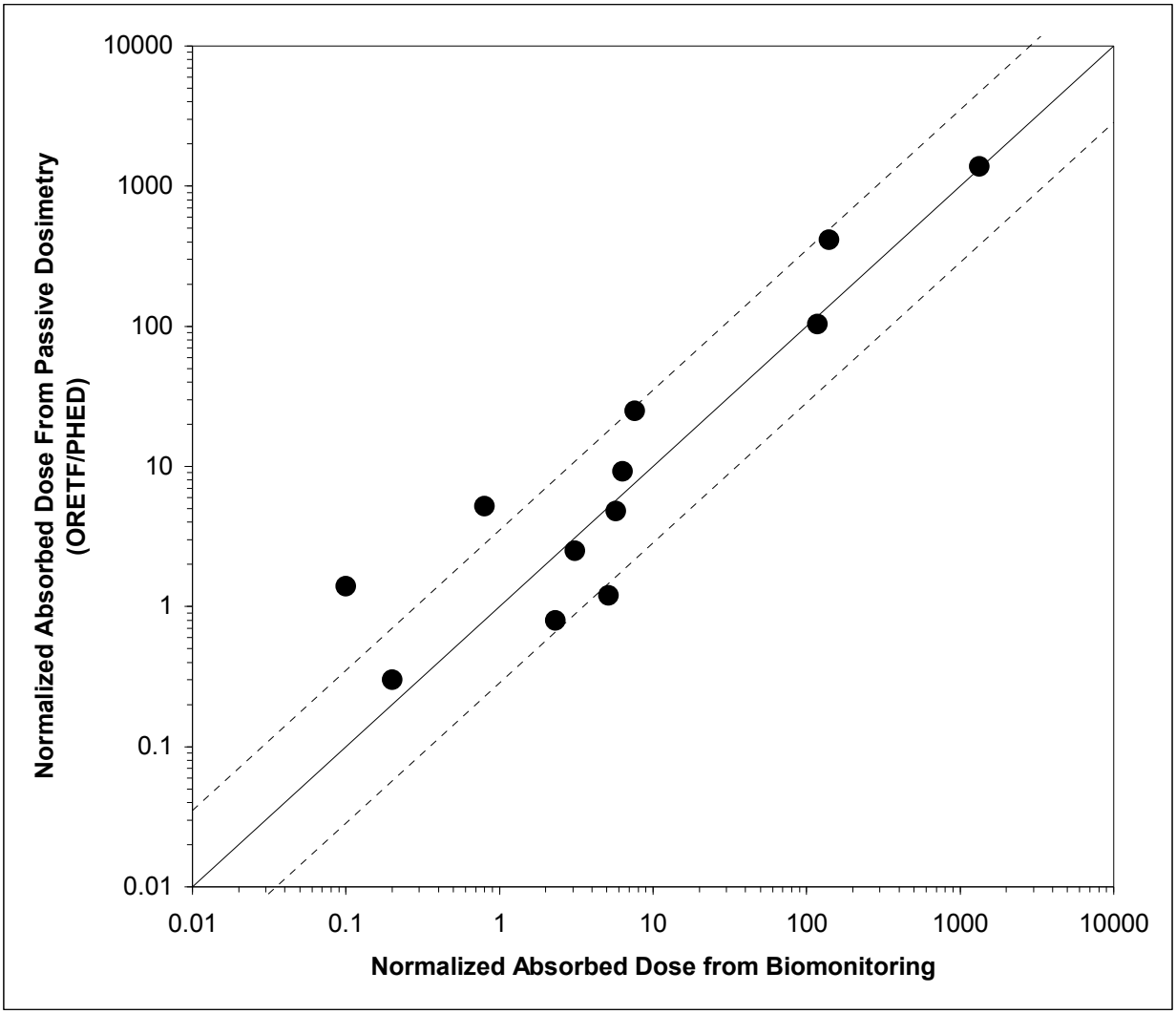
Table 1 (contd.). SUMMARY TABLE FOR DATA PRESENTED IN APPENDIX 2 - NORMALIZED ORETF AND PHED DATA COMPARED TO DATA FROM BIOLOGICAL MONITORING STUDIES

		ORETF or PHED Data			**Data from Biological Monitoring Study**				
Reference	Scenario	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage	Passive Dosim. - Normalized Estimated Absorbed Dosage	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage	Passive Dosim. - Normalized Estimated Absorbed Dosage	Normalized Biomon Dosage	Ratio of ORETF or PHED PD/Biomon Dosage
		µg/lb AI Handled							
Comparison #5 PHED/ Honeycutt 1994	Open Cab Airblast Application	6.6	2.6	9.2	2.7	0.3	3.3	6.3	1.5
Comparison #6 PHED/ Knuteson 1999	Open Pour Liquid	0.7	0.7	1.4	0.06	0.04	0.1	0.1	12
Comparison #7 PHED/ Shurdut 1993	Open Cab Groundboom Application of Spray	0.4	0.4	0.8	0.7	1.0	1.8	2.3	0.4
Comparison #8 PHED/ Findlay 1998	Liquid Backpack M/L/A	7.5	17	25	19297	6.6	61	7.6	3.2

Table 1 (contd.). SUMMARY TABLE FOR DATA PRESENTED IN APPENDIX 2 - NORMALIZED ORETF AND PHED DATA COMPARED TO DATA FROM BIOLOGICAL MONITORING STUDIES

		ORETF or PHED Data			**Data from Biological Monitoring Study**				
Reference	Scenario	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage	Passive Dosim. - Normalized Estimated Absorbed Dosage	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage	Passive Dosim. - Normalized Estimated Absorbed Dosage	Normalized Biomon Dosage	Ratio of ORETF or PHED PD/Biomon Dosage
		µg/lb AI Handled							
Comparison #9 PHED/ Chester 1986	Open Pour Liquid & Open Cab Groundboom Application	2.5	---	2.5	4.2	---	4.2	3.1	0.8
Comparison #10 PHED/ Selman, 1996	Applicator, Closed cab, sprays	0.3	0.02	0.3	0.3	0.01	0.3	0.2	1.9
Comparison #11 PHED/ Selman, 1996	Liquid M/L/A, Open pour & CCGB Applic.	5.0	0.2	5.2	2.7	0.06	2.8	0.8	6.2
Comparison #12 PHED/ Grover, 1986	Liquid M/L/A, Open pour & CCGB Applic.	4.8	---	4.8	13	---	13	5.7	0.8

Figure 1. Plot of Normalized Absorbed Dose From Passive Dosimetry Versus Biomonitoring



Appendix 1

Scenario Summary Data Sheets From the

PHED Surrogate Exposure Guide Estimates of Worker Exposure

From The Pesticide Handler Exposure Database Version 1.1, August 1998.

SCENARIO 3. ALL LIQUIDS, OPEN MIXING and LOADING (MLOD)

Dermal Exposure

Clothing Scenario	Head and Neck (mg/lb ai handled)	+	Upper and Lower Arm, Chest, Back, Thigh and Lower Leg (mg/lb ai handled)	+	Hand (mg/lb ai handled)	=	**TOTAL Dermal Exposure** (mg/lb ai handled)
No Clothing	0.00527		0.301		2.84		**3.1**
Single Layer, No Gloves	0.00527		0.0110		2.840		**2.9**
Single Layer, Gloves	0.00527		0.0110		0.00671		**0.023**

Dermal Exposure Data Confidence and Items of Note

Clothing Scenario	**Data Confidence/Items of Note**
No Clothes	Dermal = 75 to 122 replicates, AB grade. Hand = 53 replicates, AB grade. **High Confidence**
Single Layer, No Gloves	Dermal = 72 to 122 replicates, AB grade. Hand = 53 replicates, AB grade. **High Confidence**
Single Layer, Gloves	Dermal = 72 to 122 replicates, AB grade. Hand = 59 replicates, AB grade. **High Confidence**

Inhalation Exposure and Data Confidence

1.2 µg/lb ai handled. Replicates = 85, AB grade. **High Confidence**

SCENARIO 11. AIRBLAST APPLICATION, OPEN CAB (APPL)

Dermal Exposure

Clothing Scenario	Head and Neck (mg/lb ai handled)	+	Upper and Lower Arm, Chest, Back, Thigh and Lower Leg (mg/lb ai handled)	+	Hand (mg/lb ai handled)	=	**TOTAL Dermal Exposure** (mg/lb ai handled)
No Clothing	0.197		1.86		0.123		**2.2**
Single Layer, No Gloves	0.197		0.0421		0.123		**0.36**
Single Layer, Gloves	0.197		0.0421		0.00243		**0.24**

Dermal Exposure Data Confidence and Items of Note

Clothing Scenario	**Data Confidence/Items of Note**
No Clothes	Dermal replicates = 33 to 44, AB grade. Hand replicates = 22 replicates, AB grade. **High Confidence**
Single Layer, No Gloves	Dermal replicates = 32 to 49, AB grade. Hand replicates = 22 replicates, AB grade. **High Confidence**
Single Layer, Gloves	Dermal replicates = 31 to 48, AB grade. Hand replicates = 18 replicates, AB grade. **High Confidence**

Inhalation Exposure and Data Confidence

4.5 µg/lb ai handled. 47 replicates, AB grade. **High Confidence**

Note: The three turf airblast replicates (golf course) are not included in this scenario. Only tree crops and grapes are included.

SCENARIO 13. GROUNDBOOM APPLICATION, OPEN CAB (APPL)

Dermal Exposure

Clothing Scenario	Head and Neck (mg/lb ai handled)	+	Upper and Lower Arm, Chest, Back, Thigh and Lower Leg (mg/lb ai handled)	+	Hand (mg/lb ai handled)	=	**TOTAL Dermal Exposure** (mg/lb ai handled)
No Clothing	0.00161		0.0381		0.00650		**0.046**
Single Layer, No Gloves	0.00161		0.00612		0.00650		**0.014**
Single Layer, Gloves	0.00161		0.00612		0.00629		**0.014**

Dermal Exposure Data Confidence and Items of Note

Clothing Scenario	**Data Confidence/Items of Note**
No Clothes	Dermal replicates = 17 to 33, AB grade. Hand replicates = 29, AB grade. **High Confidence**
Single Layer, No Gloves	Dermal replicates = 23 to 42, AB grade. Hand replicates = 29, AB grade. The neck location is limited to 23 observations; the next lowest number of observations is 32. **High Confidence**
Single Layer, Gloves	Dermal replicates = 23 to 42, AB grade. Hand replicates = 21, ABC grade. The neck location is limited to 23 observations; the next lowest number of observations is 32. **Medium Confidence**

Inhalation Exposure and Data Confidence

0.74 µg/lb ai handled. 22 replicates, AB grade. **High Confidence**

SCENARIO 14. GROUNDBOOM APPLICATION, ENCLOSED CAB (APPL)

Dermal Exposure

Clothing Scenario	Head and Neck (mg/lb ai handled)	+	Upper and Lower Arm, Chest, Back, Thigh and Lower Leg (mg/lb ai handled)	+	Hand (mg/lb ai handled)	=	**TOTAL Dermal Exposure** (mg/lb ai handled)
No Clothing	0.000171		0.00933		0.000836		**0.010**
Single Layer, No Gloves	0.000171		0.00401		0.000836		**0.0050**
Single Layer, Gloves	0.000171		0.00401		0.0009		**0.0051**

Dermal Exposure Data Confidence and Items of Note

Clothing Scenario	**Data Confidence/Items of Note**
No Clothes	Dermal replicates = 13 to 26, ABC grade. Hand replicates = 16, ABC grade. **Low Confidence** due to the low number of replicates per body part.
Single Layer, No Gloves	Dermal replicates = 20 to 31, ABC grade. Hand replicates = 16, ABC grade. **Medium Confidence**
Single Layer, Gloves	Dermal replicates = 20 to 31, ABC grade. Hand replicates = 12, All grade. **Low Confidence** due to the grades and small number of hand replicates.

Inhalation Exposure and Data Confidence

0.043 µg/lb ai handled. 16 replicates, AB grade. **High Confidence**

SCENARIO 29. LIQUID or DRY FLOWABLE/OPEN POUR/GROUNDBOOM/ENCLOSED CAB (MLAP)

Dermal Exposure

Clothing Scenario	Head and Neck (mg/lb ai handled)	+	Upper and Lower Arm, Chest, Back, Thigh and Lower Leg (mg/lb ai handled)	+	Hand (mg/lb ai handled)	=	**TOTAL Dermal Exposure** (mg/lb ai handled)
No Clothing	0.00780		0.141		0.0731		**0.22**
Single Layer, No Gloves	0.00780		0.00807		0.0731		**0.089**
Single Layer, Gloves	0.00780		0.00807		0.0135		**0.029**

Dermal Exposure Data Confidence and Items of Note

Clothing Scenario	Data Confidence/Items of Note
No Clothes	Dermal = 29 to 38 replicates, ABC grade. Hand = 14 replicates, AB grade. **Low Confidence** due to inadequate replicate number.
Single Layer, No Gloves	Dermal = 17 to 38 replicates, ABC grade. Hand = 14 replicates, AB grade. **Low Confidence** due to inadequate replicate number.
Single Layer, Gloves	Dermal = 17 to 38 replicates, ABC grade. Hand = 24 replicates, AB grade. **Medium Confidence**

Inhalation Exposure and Data Confidence

INHALATION EXPOSURE: 0.35 µg/lb ai handled. 15 replicates, ABC grade. **Medium Confidence**

This use scenario includes both dry flowable replicates and liquid replicates in the Mixing/Loading portion of this analysis. This was only done because of the limited number of replicates for some body parts for this use scenario. This is not a recommended subsetting practice (under normal circumstances the formulation for the mixing/loading portion should have been dry flowable or liquid, but never the two combined). The reviewer may wish to take the separate M/L value for liquid or dry flowable and the separate applicator exposure value for groundboom enclosed cab and combine them together.

SCENARIO 34. LIQUID/OPEN POUR/BACKPACK (MLAP)

Dermal Exposure

Clothing Scenario	Head and Neck (mg/lb ai handled)		Upper and Lower Arm, Chest, Back, Thigh and Lower Leg (mg/lb ai handled)		Hand (mg/lb ai handled)	=	**TOTAL Dermal Exposure** (mg/lb ai handled)
No Clothing	0.742	+	22.1	+	No Data	=	**See Note** (below)
Single Layer, No Gloves	0.742		1.72		No Data		**See Note** (below)
Single Layer, Gloves	0.742		1.72		0.00462		**2.5**

Dermal Exposure Data Confidence and Items of Note

Clothing Scenario	**Data Confidence/Items of Note**
No Clothes	Dermal replicates = 11, AB grade. Hand replicates = 0. **Low Confidence** due to the inadequate replicate number. "No glove" hand data are unavailable for this use scenario. Seven of the 11 glove observations are nondetect. It is not advisable to back calculate a "no glove" scenario.
Single Layer, No Gloves	Dermal replicates = 9 to 11, AB grade. Hand replicates = 0. **Low Confidence** due to the inadequate replicate number. "No glove" hand data are unavailable for this use scenario. Seven of the 11 glove observations are nondetect. It is not advisable to back calculate a "no glove" scenario.
Single Layer, Gloves	Dermal replicates = 9 to 11, AB grade. Hand replicates = 11, C grade**.** **Low Confidence** due to the inadequate replicate number.

Inhalation Exposure and Data Confidence

INHALATION EXPOSURE: 30 µg/lb ai applied. 11 replicates, A grade. **Low Confidence** due to inadequate replicate number.

Appendix 2

Description of Studies and Calculations for Comparison of ORETF and PHED Data

to

Biomonitoring Data Described by Ross et al., 2006

APPENDIX 2

Table 1. DATA FOR COMPARISON OF ORETF AND PHED DATA TO BIOMONITORING AND PASSIVE DOSIMETRY

1	2	3	4	5	6	7	8
Reference	Scenario	# Reps	Passive Dosim. - Dermal Dosage	Passive Dosim. - Inhalation Dosage	Passive Dosim. - Estimated Absorbed Dosage	Biomon. Dosage	Comments
			ug/kg				
Rosenheck 2000	Hose-end Sprayer - Lawn	12	1.0	0.07	1.2	1.0	clothing scenario is t-shirt and shorts and no gloves
ORETF 2002	Hose-end Sprayer - Lawn	30	---	---	---	---	clothing scenario is t-shirt and shorts and no gloves
Rosenheck 2000	RTU Hose-end - Lawn	11	0.32	0.26	0.63	0.84	clothing scenario is t-shirt and shorts and no gloves
ORETF 2002	RTU Hose-end - Lawn	30	---	---	---	---	clothing scenario is t-shirt and shorts and no gloves
Rosenheck 2000	Hand Pump Sprayer - Lawn & Ornamentals	10	0.11	0.039	0.17	0.4	clothing scenario is t-shirt and shorts and no gloves
ORETF 2002	Hand Pump Sprayer Garden	20	---	---	---	---	clothing scenario is t-shirt and shorts and no gloves
Honeycutt 1994	Liquid Open Pour M/L	12	2.0	0.13	2.2	5.4	coveralls over SS & LP, helmets, resp, gog, CR gloves
PHED	Scen. 3- Open pour liq	59-122	---	---	---	---	single layer with gloves value used but with body value decreased by 1/2 for 2nd layer of clothes
Honeycutt 1994	Applicator OC Airblast	11	2.9	0.33	3.5	6.7	open cab; coveralls over SS & LP, helmets, resp, gog, CR gloves
PHED	Scen. 11- OC Airblast Applic.	18-48	---	---	---	---	single layer with gloves value used but with body value decreased by 1/2 for 2nd layer of clothes

APPENDIX 2

Table 1. DATA FOR COMPARISON OF ORETF AND PHED DATA TO BIOMONITORING AND PASSIVE DOSIMETRY

1	2	3	4	5	6	7	8
Reference	Scenario	# Reps	Passive Dosim. - Dermal Dosage	Passive Dosim. - Inhalation Dosage	Passive Dosim. - Estimated Absorbed Dosage	Biomon. Dosage	Comments
			ug/kg				
Knuteson 1999	Liquid M/L Aerial	11	0.34	0.23	0.68	0.71	coveralls, apron, gog, cap, gloves; inhal rate
PHED	Scen. 3- Open Pour liq	59-122	---	---	---	---	single layer with gloves value used
Shurdut 1993	OCGB Applic.- Liq	8	0.61	0.84	1.5	1.9	groundboom in open cabs; coverall, cap, goggle, CR boots
PHED	Scen. 13- OCGB Applic.- Liq	23-42	---	---	---	---	single layer no gloves value used
Findlay 1998	Liquid Backpack M/L/A	20	204	0.07	0.65	0.08	assumed middle of narrow AI range; faceshield & gloves during M/L; LS & LP
PHED	Scen. 34- OP liq Backpack M/L/A	9 to 11	---	---	---	---	only a single layer with gloves available in PHED; gloves worn in study only during M/L so PHED may significantly underestimate the dermal dosage
Chester 1986	Groundboom M/L/A	10	7.9	not collected	7.9	5.8	coverall, gloves, facemask; no inhalation monitoring
PHED	Scen. 29- OP liq CCGB	17-38	---	---	---	---	single layer with gloves value used
Selman 1996	Applicator, Closed cab, sprays	7	1.3	0.054	1.4	0.81	LS & LP
PHED	Scen. 14- CCGB Applic-liq	16-31	---	---	---	---	single layer, NO gloves

APPENDIX 2

Table 1. DATA FOR COMPARISON OF ORETF AND PHED DATA TO BIOMONITORING AND PASSIVE DOSIMETRY

1	2	3	4	5	6	7	8
Reference	Scenario	# Reps	Passive Dosim. - Dermal Dosage	Passive Dosim. - Inhalation Dosage	Passive Dosim. - Estimated Absorbed Dosage	Biomon. Dosage	Comments
			ug/kg				
Selman 1996	Liquid M/L/A, Open pour & CCGB Applic.	4	5.1	0.12	5.3	1.6	LS & LP
PHED	Scen. 29- OP liq CCGB	14-38	---	---	---	---	single layer, NO gloves
Grover 1986	Liquid M/L/A, Open pour & CCGB Applic.	7	33.8	not collected	33.8	14.3	2 layers of cotton clothing
PHED	Scen. 29- OP liq CCGB	14-38	---	---	---	---	single layer no gloves value used but with body value decreased by 1/2 for 2nd layer of clothes

APPENDIX 2
Table 1. DATA FOR COMPARISON OF ORETF AND PHED DATA TO BIOMONITORING AND PASSIVE DOSIMETRY

FOOTNOTES

COLUMN 1 - Studies are listed in Ross et., 2006, Klonne, 2002, or PHED v. 1.1, 1998 - see Ross paper for full citations

COLUMN 2 - Description of exposure scenario; for PHED sources the actual Scenario Number is also cited

COLUMNS 3 through 7 - All non-ORETF and all non-PHED references are data taken directly from Ross et al., 2006, Tables 3 and 5; ORETF sources are from Klonne, 2002, and all PHED sources are from PHED, 1998

COLUMN 4 - Values are dermally absorbed dose estimated from passive dosimetry measurements after correction for dermal absorption of the active ingredient (AI); see Table 1 of Ross et al. 2006

COLUMN 5 - Dose via the inhalation route estimated from passive dosimetry assuming 16.7 LPM breathing rate and 100% absorption

COLUMN 6 - Estimated absorbed dosage based on passive dosimetry methodology; values may not sum exactly since values in Colums 4 and 5 are geometric mean values

COLUMN 7 - Absorbed dose determined by biological monitoring

APPENDIX 2

Table 2. Adjustment of Inhalation Rates From Original ORETF or PHED Passive Dosimetry Values to the Inhalation Rate Value

1	2	3	4	5	6	7
Assumed for the Biomonitoring Calculations						
Reference	Scenario	# Reps	Original Inhalation Rate Used for Unit Exposure Calculations (LPM)	Original Normalized Inhalation Dosage Value (ug/lb AI Handled)	Ratio of 16.7 LPM Rate Used in all Biomonitoring Calculations / Original Inhalation Rate	Adjusted Normalized Inhalation Dosage Value (ug/lb AI Handled)
ORETF 2002	Hose-end Sprayer - Lawn	30	17	17.3	1.0	17
ORETF 2002	RTU Hose-end - Lawn	30	17	10.4	1.0	10
ORETF 2002	Hand Pump Sprayer Garden	20	17	5.3	1.0	5.2
PHED	Scen. 3- Open pour liq	59-122	29	1.2	0.6	0.7
PHED	Scen. 11- OC Airblast Applic.	18-48	29	4.5	0.6	2.6
PHED	Scen. 3- Open Pour liq	59-122	29	1.2	0.6	0.7
PHED	Scen. 13- OCGB Applic.- Liq	23-42	29	0.74	0.6	0.4
PHED	Scen. 34- OP liq Backpack M/L/A	9 to 11	29	30	0.6	17

APPENDIX 2

Table 2. Adjustment of Inhalation Rates From Original ORETF or PHED Passive Dosimetry Values to the Inhalation Rate Value

1	2	3	4	5	6	7
Assumed for the Biomonitoring Calculations						
Reference	Scenario	# Reps	Original Inhalation Rate Used for Unit Exposure Calculations (LPM)	Original Normalized Inhalation Dosage Value (ug/lb AI Handled)	Ratio of 16.7 LPM Rate Used in all Biomonitoring Calculations / Original Inhalation Rate	Adjusted Normalized Inhalation Dosage Value (ug/lb AI Handled)
PHED	Scen. 29- OP liq CCGB	17-38	---	---	---	---
PHED	Scen. 14- CCGB Applic-liq	16-31	29	0.043	0.6	0.02
PHED	Scen. 29- OP liq CCGB	14-38	29	0.35	0.6	0.2
PHED	Scen. 29- OP liq CCGB	14-38	---	---	---	---

FOOTNOTES

COLUMN 1 - Studies are ORETF studies from Klonne, 2002, or PHED v. 1.1, 1998

COLUMN 2 - Description of exposure scenario; for PHED sources the actual Scenario Number is also cited

COLUMN 4 - Original inhalation rates assumed for calculating the unit exposure

COLUMN 5 - Original unit exposure value listed in the report

COLUMN 6 - All inhalation data in the biomonitoring paper by Ross et al. were adjusted for a single inhalation rate of 16.7 LPM;

this value is then divided by the Original Inhalation Rate

COLUMN 7 - Adjusted Normalized Inhalation Dosage Value = Original Normalized Inhalation Dosage Value x the Ratio

value calculated in Column 6

APPENDIX 2
Table 3. DATA NORMALIZED FOR AMOUNT AI HANDLED FOR COMPARISON OF ORETF AND PHED DATA

1	2	3	4	5	6	7	8	9	10
TO BIOMONITORING AND PASSIVE DOSIMETRY									
Reference	Scenario	Lbs AI Handled	Dermal Absorption for Biomon. Chemical (%)	Passive Dosim. - Dermally Deposited Residue	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage Value	Passive Dosim. - Normalized Estimated Absorbed Dosage	Normalized Biomon Dosage	Ratio of ORETF or PHED PD/Biomon Dosage
				ug/lb AI Handled					
Rosenheck 2000	Hose-end Sprayer - Lawn	0.5	3.6	---	140	9.8	168	140	3.0
ORETF 2002	Hose-end Sprayer - Lawn	0.5	---	11000	396	17	413	---	
Rosenheck 2000	RTU Hose-end - Lawn	0.5	3.6	---	45	36	88	118	0.9
ORETF 2002	RTU Hose-end - Lawn	0.5	---	2610	94	10	104	---	
Rosenheck 2000	Hand Pump Sprayer - Lawn & Ornamentals	0.021	3.6	---	367	130	567	1333	1.0
ORETF 2002	Hand Pump Sprayer Garden	0.017	---	38200	1375	5.2	1380	---	
Honeycutt 1994	Liquid Open Pour M/L	74	3.0	---	1.9	0.1	2.1	5.1	0.2
PHED	Scen. 3- Open pour liq	---		17	0.5	0.7	1.2	---	
Honeycutt 1994	Applicator OC Airblast	74	3.0	---	2.7	0.3	3.3	6.3	1.5
PHED	Scen. 11- OC Airblast Applic.	---		220	6.6	2.6	9.2	---	

APPENDIX 2
Table 3. DATA NORMALIZED FOR AMOUNT AI HANDLED FOR COMPARISON OF ORETF AND PHED DATA

1	2	3	4	5	6	7	8	9	10
TO BIOMONITORING AND PASSIVE DOSIMETRY									
Reference	Scenario	Lbs AI Handled	Dermal Absorption for Biomon. Chemical (%)	Passive Dosim. - Dermally Deposited Residue	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage Value	Passive Dosim. - Normalized Estimated Absorbed Dosage	Normalized Biomon Dosage	Ratio of ORETF or PHED PD/Biomon Dosage
				ug/lb AI Handled					
Knuteson 1999	Liquid M/L Aerial	430	3.0	---	0.06	0.04	0.1	0.1	
									12
PHED	Scen. 3- Open Pour liq	---		23	0.7	0.7	1.4	---	
Shurdut 1993	OCGB Applic.- Liq	58	3.0	---	0.7	1.0	1.8	2.3	
									0.4
PHED	Scen. 13- OCGB Applic.- Liq	---		14	0.4	0.4	0.8	---	
Findlay 1998	Liquid Backpack M/L/A	0.74	0.3	---	19297	6.6	61	7.6	
									3.2
PHED	Scen. 34- OP liq Backpack M/L/A	---		2500	7.5	17	25	---	
Chester 1986	Groundboom M/L/A	132	8.5	---	4.2	---	4.2	3.1	
									0.8
PHED	Scen. 29- OP liq CCGB	---		29	2.5	---	2.5	---	
Selman 1996	Applicator, Closed cab, sprays	357	5.6	---	0.3	0.01	0.3	0.2	
									1.9
PHED	Scen. 14- CCGB Applic-liq	---		5	0.3	0.02	0.3	---	

APPENDIX 2

Table 3. DATA NORMALIZED FOR AMOUNT AI HANDLED FOR COMPARISON OF ORETF AND PHED DATA

1	2	3	4	5	6	7	8	9	10
TO BIOMONITORING AND PASSIVE DOSIMETRY									
Reference	Scenario	Lbs AI Handled	Dermal Absorption for Biomon. Chemical (%)	Passive Dosim. - Dermally Deposited Residue	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage Value	Passive Dosim. - Normalized Estimated Absorbed Dosage	Normalized Biomon Dosage	Ratio of ORETF or PHED PD/Biomon Dosage
				ug/lb AI Handled					
Selman 1996	Liquid M/L/A, Open pour & CCGB Applic.	133	5.6	---	2.7	0.06	2.8	0.8	
PHED	Scen. 29- OP liq CCGB	---		89	5.0	0.2	5.2	---	6.2
Grover 1986	Liquid M/L/A, Open pour & CCGB Applic.	176	5.7	---	13	---	13	5.7	
PHED	Scen. 29- OP liq CCGB	---		85	4.8	---	4.8	---	0.8

APPENDIX 2
Table 3. DATA NORMALIZED FOR AMOUNT AI HANDLED FOR COMPARISON OF ORETF AND PHED DATA

TO BIOMONITORING AND PASSIVE DOSIMETRY

FOOTNOTES

COLUMN 1 - Studies are listed in Ross et., 2006, Klonne, 2002, or PHED v. 1.1, 1998 - see Ross paper for full citations

COLUMN 2 - Description of exposure scenario; for PHED sources the actual Scenario Number is also cited

COLUMN 3 - All non-ORETF and all non-PHED references are data taken directly from Ross et al., 2006 or supplied by J.Ross or G. Chester;

ORETF sources are from Klonne, 2002, and all PHED sources are from PHED, 1998

COLUMN 4 - Dermal absorption values are from Table 1 of Ross et al. 2006

COLUMN 5 - Values are the dermally deposited residues for the appropriate clothing scenario derived from passive dosimetry clothing,

face/neck wipes, and hand washes

COLUMN 6 - All non-ORETF and all non-PHED references are Passive Dosimetry Dermal Dosage values from Table 1 that have been multiplied by 70 kg (assumed BW to obtain the total ug of residue) and then divided by the pounds AI handled to obtain the normalized passive dosimetry dermal dosage; for ORETF and PHED references, the total dermally deposited residue in Column 5 is multiplied by the

dermal absorption value in Column 4 (after transforming it to a percentage value) to obtain the normalized absorbed dermal exposure; this is appropriate because the passive dosimetry data are considered to be generic and they are adjusted by the

AI-specific dermal absorption value from the biomonitoring study for the purpose of direct comparison.

COLUMN 7 - Dose via the inhalation route estimated from passive dosimetry assuming 16.7 LPM breathing rate and 100% absorption. All non-ORETF and all non-PHED references are Passive Dosimetry Inhalation Dosage values from Table 1 that have been multiplied by 70 kg (assumed BW to obtain the total ug of residue) and then divided by the pounds AI handled to obtain the normalized passive

dosimetry dosage; for ORETF and PHED references, the adjusted inhalation values are from Klonne, 2002, and from PHED, 1998, respectively, and have been adjusted to a 16.7 LPM breathing rate (see Table 2 of this appendix).

APPENDIX 2
Table 3. DATA NORMALIZED FOR AMOUNT AI HANDLED FOR COMPARISON OF ORETF AND PHED DATA

FOOTNOTES (contd.)

TO BIOMONITORING AND PASSIVE DOSIMETRY

COLUMN 8 - All non-ORETF and all non-PHED references are Passive Dosimetry Estimated Absorbed Dosage values from Table 1 that have been multiplied by 70 kg (assumed BW to obtain the total ug of residue) and then divided by the pounds AI handled to obtain the total normalized estimated absorbed dosage

COLUMN 9 - Values are Biological Monitoring Dosage values from Table 1 that have been multiplied by 70 kg (assumed BW to obtain the total ug of residue) and then divided by the pounds AI handled to obtain the total normalized biological monitoring dosage

COLUMN 10 - Values are the ratio of the Passive Dosimetry - Normalized Estimated Absorbed Dosage from Column 8 for all ORETF or PHED references to the Normalized Biological Monitoring Dosage from Column 9

APPENDIX 2

Table 4. SUMMARY TABLE FOR DATA PRESENTED IN TABLE 3 - NORMALIZED ORETF AND PHED DATA COMPARED TO DATA FROM BIOLOGICAL MONITORING STUDIES

		ORETF or PHED Data			Data from Biological Monitoring Study				
Reference	Scenario	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage	Passive Dosim. - Normalized Estimated Absorbed Dosage	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage	Passive Dosim. - Normalized Estimated Absorbed Dosage	Normalized Biomon Dosage	Ratio of ORETF or PHED PD/Biomon Dosage
		ug/lb AI Handled							
ORETF 2002/ Rosenheck 2000	Hose-end Sprayer - Lawn	396	17	413	140	9.8	168	140	3.0
ORETF 2002/ Rosenheck 2000	RTU Hose-end - Lawn	94	10	104	45	36	88	118	0.9
ORETF 2002/ Rosenheck 2000	Hand Pump Sprayer - Lawn & Ornamentals	1375	5.2	1380	367	130	567	1333	1.0
PHED/ Honeycutt 1994	Liquid Open Pour M/L	0.5	0.7	1.2	1.9	0.1	2.1	5.1	0.2
PHED/ Honeycutt 1994	Open Cab Airblast Application	6.6	2.6	9.2	2.7	0.3	3.3	6.3	1.5
PHED/ Knuteson 1999	Open Pour Liquid	0.7	0.7	1.4	0.06	0.04	0.1	0.1	12

APPENDIX 2

Table 4. SUMMARY TABLE FOR DATA PRESENTED IN TABLE 3 - NORMALIZED ORETF AND PHED DATA COMPARED TO DATA FROM BIOLOGICAL MONITORING STUDIES

		ORETF or PHED Data			Data from Biological Monitoring Study				
Reference	Scenario	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage	Passive Dosim. - Normalized Estimated Absorbed Dosage	Passive Dosim. - Normalized Dermal Dosage	Passive Dosim. - Normalized Inhalation Dosage	Passive Dosim. - Normalized Estimated Absorbed Dosage	Normalized Biomon Dosage	Ratio of ORETF or PHED PD/Biomon Dosage
		ug/lb AI Handled							
PHED/ Shurdut 1993	Open Cab Groundboom Application of Spray	0.4	0.4	0.8	0.7	1.0	1.8	2.3	0.4
PHED/ Findlay 1998	Liquid Backpack M/L/A	7.5	17	25	19297	6.6	61	7.6	3.2
PHED/ Chester 1986	Open Pour Liquid & Open Cab Groundboom Application	2.5	---	2.5	4.2	---	4.2	3.1	0.8
PHED/ Selman 1996	Applicator, Closed cab, sprays	0.3	0.02	0.3	0.3	0.01	0.3	0.2	1.9
PHED/ Selman 1996	Liquid M/L/A, Open pour & CCGB Applic.	5.0	0.2	5.2	2.7	0.06	2.8	0.8	6.2
PHED/ Grover 1986	Liquid M/L/A, Open pour & CCGB Applic.	4.8	---	4.8	13	---	13	5.7	0.8