

## APPENDIX P-3.

### Pulmonary Analysis Tables Occupation and Body Fat Removed from Final Model

This appendix contains results of exposure analyses after occupation and body fat have been removed from those final dioxin models (Models 2 through 6) that contained occupation or body fat. These analyses are performed to investigate the relationship of the dependent variable to dioxin without adjusting any effects due to occupation or body fat. The format of these tables closely parallels the adjusted panels of Chapter 20 tables. A summary of the tables found in this appendix follows.

Appendix P-3 Table	Chapter 20 Table	Dependent Variable
P-3-1	20-3	Asthma
P-3-2	20-4	Bronchitis
P-3-3	20-5	Pneumonia
P-3-4	20-6	Thorax and Lung Abnormalities
P-3-5	20-7	X Ray Interpretation
P-3-6	20-8	FVC
P-3-7	20-9	FEV <sub>1</sub>
P-3-8	20-10	Ratio of Observed FVC to Observed FEV <sub>1</sub>
P-3-9	20-11	Loss of Vital Capacity
P-3-10	20-12	Obstructive Abnormality

**Table P-3-1.  
Analysis of Asthma  
Occupation and Body Fat Removed from Final Model**

<b>a) MODEL 2: RANCH HANDS -- INITIAL DIOXIN -- ADJUSTED</b>			
<b>Analysis Results for Log<sub>2</sub> (Initial Dioxin)<sup>a</sup></b>			
<b>n</b>	<b>Adj. Relative Risk (95% C.I.)<sup>b</sup></b>	<b>p-Value</b>	<b>Covariate Remarks</b>
514	1.08 (0.75,1.55)	0.693	RACE (p=0.212) AGE*PACKYR (p=0.023)

<sup>a</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

<sup>b</sup> Relative risk for a twofold increase in initial dioxin.

<b>b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY -- ADJUSTED</b>					
<b>Dioxin Category</b>	<b>n</b>	<b>Adj. Relative Risk (95% C.I.)<sup>ab</sup></b>		<b>p-Value</b>	<b>Covariate Remarks</b>
Comparison	1,054				AGE*RACE (p=0.027) RACE*PACKYR (p=0.031)
Background RH	369	1.59	(0.85,3.00)	0.149	
Low RH	257	1.39	(0.66,2.93)	0.394	
High RH	257	1.41	(0.67,2.99)	0.362	
Low plus High RH	514	1.40	(0.78,2.53)	0.264	

<sup>a</sup> Relative risk and confidence interval relative to Comparisons.

<sup>b</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

Note: RH = Ranch Hand.

Comparison: Current Dioxin ≤ 10 ppt.

Background (Ranch Hand): Current Dioxin ≤ 10 ppt.

Low (Ranch Hand): Current Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 143 ppt.

High (Ranch Hand): Current Dioxin > 10 ppt, Initial Dioxin > 143 ppt.

**Table P-3-1. (Continued)**  
**Analysis of Asthma**  
**Occupation and Body Fat Removed from Final Model**

c) MODELS 4, 5, AND 6: RANCH HANDS – CURRENT DIOXIN – ADJUSTED				
Analysis Results for Log <sub>2</sub> (Current Dioxin + 1)				
Model <sup>a</sup>	n	Adj. Relative Risk (95% C.I.) <sup>b</sup>	p-Value	Covariate Remarks
4	884	1.04 (0.82,1.31)**	0.765**	CURR*AGE (p=0.035) AGE*RACE (p=0.039)
5	884	0.98 (0.81,1.20)	0.874	AGE*RACE (p=0.039)
6 <sup>c</sup>	883	1.04 (0.84,1.29)**	0.730**	CURR*AGE (p=0.044) AGE*RACE (p=0.037)

<sup>a</sup> Model 4: Log<sub>2</sub> (lipid-adjusted current dioxin + 1).  
 Model 5: Log<sub>2</sub> (whole-weight current dioxin + 1).  
 Model 6: Log<sub>2</sub> (whole-weight current dioxin + 1), adjusted for log<sub>2</sub> total lipids.

<sup>b</sup> Relative risk for a twofold increase in current dioxin.

<sup>c</sup> Adjusted for log<sub>2</sub> total lipids in addition to covariates specified under "Covariate Remarks" column.

\*\* Log<sub>2</sub> (current dioxin + 1)-by-covariate interaction (0.01 < p ≤ 0.05); adjusted relative risk, confidence interval, and p-value derived from a model after deletion of this interaction; refer to Appendix Table P-4-1 for further analysis of this interaction.

**Table P-3-2.**  
**Analysis of Bronchitis**  
**Occupation and Body Fat Removed from Final Model**

<b>a) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED</b>				
<b>Dioxin Category</b>	<b>n</b>	<b>Adj. Relative Risk (95% C.I.)<sup>ab</sup></b>	<b>p-Value</b>	<b>Covariate Remarks</b>
Comparison	1,038			PACKYR (p=0.008) IC (p=0.008)
Background RH	363	1.33 (0.98,1.80)	0.065	
Low RH	251	1.03 (0.72,1.48)	0.883	
High RH	254	0.99 (0.69,1.43)	0.978	
Low plus High RH	505	1.01 (0.76,1.34)	0.939	

<sup>a</sup> Relative risk and confidence interval relative to Comparisons.

<sup>b</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

Note: RH = Ranch Hand.

Comparison: Current Dioxin  $\leq$  10 ppt.

Background (Ranch Hand): Current Dioxin  $\leq$  10 ppt.

Low (Ranch Hand): Current Dioxin > 10 ppt, 10 ppt < Initial Dioxin  $\leq$  143 ppt.

High (Ranch Hand): Current Dioxin > 10 ppt, Initial Dioxin > 143 ppt.

**Table P-3-2. (Continued)**  
**Analysis of Bronchitis**  
**Occupation and Body Fat Removed from Final Model**

b) MODELS 4, 5, AND 6: RANCH HANDS – CURRENT DIOXIN – ADJUSTED				
Analysis Results for Log <sub>2</sub> (Current Dioxin + 1)				
Model <sup>a</sup>	n	Adj. Relative Risk (95% C.I.) <sup>b</sup>	p-Value	Covariate Remarks
4	868	0.90 (0.80,1.01)**	0.076**	CURR*IC (p=0.013) PACKYR (p=0.056)
5	868	0.93 (0.84,1.03)**	0.138**	CURR*IC (p=0.009) PACKYR (p=0.053)
6 <sup>c</sup>	886	0.89 (0.80,0.99)**	0.035**	CURR*IC (p=0.009)

<sup>a</sup> Model 4: Log<sub>2</sub> (lipid-adjusted current dioxin + 1).  
 Model 5: Log<sub>2</sub> (whole-weight current dioxin + 1).  
 Model 6: Log<sub>2</sub> (whole-weight current dioxin + 1), adjusted for log<sub>2</sub> total lipids.

<sup>b</sup> Relative risk for a twofold increase in current dioxin.

<sup>c</sup> Adjusted for log<sub>2</sub> total lipids in addition to covariates specified under "Covariate Remarks" column.

\*\* Log<sub>2</sub> (current dioxin + 1)-by-covariate interaction (p ≤ 0.05); adjusted relative risk, confidence interval, and p-value derived from a model after deletion of this interaction; refer to Appendix Table P-4-2 for further analysis of this interaction.

**Table P-3-3.  
Analysis of Pneumonia  
Body Fat Removed from Final Model**

<b>a) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED</b>				
<b>Dioxin Category</b>	<b>n</b>	<b>Adj. Relative Risk (95% C.I.)<sup>ab</sup></b>	<b>p-Value</b>	<b>Covariate Remarks</b>
Comparison	1,018			AGE*PACKYR (p=0.020)
Background RH	349	0.85 (0.57,1.26)	0.413	
Low RH	243	0.59 (0.36,0.97)	0.039	
High RH	252	0.50 (0.29,0.85)	0.011	
Low plus High RH	495	0.55 (0.37,0.80)	0.002	

<sup>a</sup> Relative risk and confidence interval relative to Comparisons.

<sup>b</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

Note: RH = Ranch Hand.

Comparison: Current Dioxin ≤10 ppt.

Background (Ranch Hand): Current Dioxin ≤10 ppt.

Low (Ranch Hand): Current Dioxin >10 ppt, 10 ppt < Initial Dioxin ≤143 ppt.

High (Ranch Hand): Current Dioxin >10 ppt, Initial Dioxin >143 ppt.

**Table P-3-4.  
Analysis of Thorax and Lung Abnormalities  
Occupation Removed from Final Model**

<b>a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED</b>			
<b>Analysis Results for Log<sub>2</sub> (Initial Dioxin)<sup>a</sup></b>			
<b>n</b>	<b>Adj. Relative Risk (95% C.I.)<sup>b</sup></b>	<b>p-Value</b>	<b>Covariate Remarks</b>
520	1.22 (0.97,1.53)	0.087	AGE (p<0.001) CSMOK (p<0.001) PACKYR (p=0.058)

<sup>a</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

<sup>b</sup> Relative risk for a twofold increase in initial dioxin.

<b>b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED</b>				
<b>Dioxin Category</b>	<b>n</b>	<b>Adj. Relative Risk (95% C.I.)<sup>ab</sup></b>	<b>p-Value</b>	<b>Covariate Remarks</b>
Comparison	1,061			AGE (p<0.001) CSMOK (p<0.001) PACKYR (p=0.001)
Background RH	373	1.45 (0.99,2.14)	0.059	
Low RH	260	1.10 (0.69,1.75)	0.679	
High RH	260	1.52 (0.97,2.39)	0.068	
Low plus High RH	520	1.29 (0.91,1.85)	0.158	

<sup>a</sup> Relative risk and confidence interval relative to Comparisons.

<sup>b</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

Note: RH = Ranch Hand.

Comparison: Current Dioxin ≤ 10 ppt.

Background (Ranch Hand): Current Dioxin ≤ 10 ppt.

Low (Ranch Hand): Current Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 143 ppt.

High (Ranch Hand): Current Dioxin > 10 ppt, Initial Dioxin > 143 ppt.

**Table P-3-4. (Continued)**  
**Analysis of Thorax and Lung Abnormalities**  
**Occupation Removed from Final Model**

<b>c) MODELS 4, 5, AND 6: RANCH HANDS – CURRENT DIOXIN – ADJUSTED</b>				
<b>Model<sup>a</sup></b>	<b>Analysis Results for Log<sub>2</sub> (Current Dioxin + 1)</b>			
	<b>n</b>	<b>Adj. Relative Risk (95% C.I.)<sup>b</sup></b>	<b>p-Value</b>	<b>Covariate Remarks</b>
4	893	1.03 (0.88,1.19)	0.739	AGE (p<0.001) CSMOK (p<0.001) PACKYR (p=0.021)
5	893	1.02 (0.90,1.16)	0.733	AGE (p<0.001) CSMOK (p<0.001) PACKYR (p=0.021)
6 <sup>c</sup>	892	1.05 (0.92,1.21)	0.463	AGE (p<0.001) CSMOK (p<0.001) PACKYR (p=0.020)

<sup>a</sup> Model 4: Log<sub>2</sub> (lipid-adjusted current dioxin + 1).  
 Model 5: Log<sub>2</sub> (whole-weight current dioxin + 1).  
 Model 6: Log<sub>2</sub> (whole-weight current dioxin + 1), adjusted for log<sub>2</sub> total lipids.

<sup>b</sup> Relative risk for a twofold increase in current dioxin.

<sup>c</sup> Adjusted for log<sub>2</sub> total lipids in addition to covariates specified under "Covariate Remarks" column.

**Table P-3-5.**  
**Analysis of X Ray Interpretation**  
**Occupation and Body Fat Removed from Final Model**

<b>a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED</b>			
<b>Analysis Results for Log<sub>2</sub> (Initial Dioxin)<sup>a</sup></b>			
<b>n</b>	<b>Adj. Relative Risk (95% C.I.)<sup>b</sup></b>	<b>p-Value</b>	<b>Covariate Remarks</b>
519	0.99 (0.80,1.22)	0.921	AGE (p=0.111) CSMOK (p=0.113)

<sup>a</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

<sup>b</sup> Relative risk for a twofold increase in initial dioxin.

<b>b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED</b>				
<b>Dioxin Category</b>	<b>n</b>	<b>Adj. Relative Risk (95% C.I.)<sup>ab</sup></b>	<b>p-Value</b>	<b>Covariate Remarks</b>
Comparison	1,063			AGE (p<0.001)
Background RH	374	1.00 (0.71,1.40)	0.982	
Low RH	260	0.93 (0.62,1.39)	0.721	
High RH	259	0.93 (0.61,1.43)	0.756	
Low plus High RH	519	0.93 (0.68,1.28)	0.664	

<sup>a</sup> Relative risk and confidence interval relative to Comparisons.

<sup>b</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

Note: RH = Ranch Hand.

Comparison: Current Dioxin ≤ 10 ppt.

Background (Ranch Hand): Current Dioxin ≤ 10 ppt.

Low (Ranch Hand): Current Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 143 ppt.

High (Ranch Hand): Current Dioxin > 10 ppt, Initial Dioxin > 143 ppt.

**Table P-3-5. (Continued)**  
**Analysis of X Ray Interpretation**  
**Occupation and Body Fat Removed from Final Model**

c) MODELS 4, 5, AND 6: RANCH HANDS — CURRENT DIOXIN — ADJUSTED				
Analysis Results for $\text{Log}_2$ (Current Dioxin + 1)				
Model <sup>a</sup>	n	Adj. Relative Risk (95% C.I.) <sup>b</sup>	p-Value	Covariate Remarks
4	892	****	****	CURR*CSMOK (p=0.005) AGE (p=0.007) PACKYR (p=0.061)
5	892	1.01 (0.90,1.14)**	0.891**	CURR*CSMOK (p=0.017) AGE (p=0.005) PACKYR (p=0.064)
6 <sup>c</sup>	892	0.96 (0.84,1.09)**	0.491**	CURR*CSMOK (p=0.010) AGE (p=0.002)

<sup>a</sup> Model 4:  $\text{Log}_2$  (lipid-adjusted current dioxin + 1).  
 Model 5:  $\text{Log}_2$  (whole-weight current dioxin + 1).  
 Model 6:  $\text{Log}_2$  (whole-weight current dioxin + 1), adjusted for  $\text{log}_2$  total lipids.

<sup>b</sup> Relative risk for a twofold increase in current dioxin.

<sup>c</sup> Adjusted for  $\text{log}_2$  total lipids in addition to covariates specified under "Covariate Remarks" column.

\*\*  $\text{Log}_2$  (current dioxin + 1)-by-covariate interaction ( $0.01 < p \leq 0.05$ ); adjusted relative risk, confidence interval, and p-value derived after deletion of this interaction; refer to Appendix Table P-4-3 for further analysis of this interaction.

\*\*\*\*  $\text{Log}_2$  (current dioxin + 1)-by-covariate interaction ( $p \leq 0.01$ ); adjusted relative risk, confidence interval, and p-value not presented; refer to Appendix Table P-4-3 for further analysis of this interaction.

**Table P-3-6.  
Analysis of FVC (Percent of Predicted)  
Occupation and Body Fat Removed from Final Model**

<b>a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED</b>						
<b>Initial Dioxin Category Summary Statistics</b>			<b>Analysis Results for Log<sub>e</sub> (Initial Dioxin)<sup>a</sup></b>			
<b>Initial Dioxin</b>	<b>n</b>	<b>Adj. Mean<sup>a</sup></b>	<b>R<sup>2</sup></b>	<b>Adj. Slope (Std. Error)</b>	<b>p-Value</b>	<b>Covariate Remarks</b>
Low	174	94.0	0.134	-1.133 (0.462)	0.015	AGE (p=0.002)
Medium	173	94.1				RACE (p<0.001)
High	173	90.7				PACKYR*IC (p=0.023)

<sup>a</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

Note: Low = 39-98 ppt; Medium = >98-232 ppt; High = >232 ppt.

<b>b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED</b>					
<b>Dioxin Category</b>	<b>n</b>	<b>Adj. Mean<sup>a</sup></b>	<b>Difference of Adj. Mean vs. Comparisons (95% C.I.)</b>	<b>p-Value</b>	<b>Covariate Remarks</b>
Comparison	1,060	95.4			CSMOK (p<0.001) IC (p=0.305)
Background RH	372	96.0	0.6 (-1.0,2.3)	0.433	AGE*PACKYR (p=0.026) PACKYR*RACE (p<0.001)
Low RH	260	95.0	-0.3 (-2.2,1.5)	0.715	
High RH	260	93.8	-1.6 (-3.4,0.2)	0.089	
Low plus High RH	520	94.4	1.0 (-0.5,2.4)	0.182	

<sup>a</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

Note: RH = Ranch Hand.

Comparison: Current Dioxin ≤ 10 ppt.

Background (Ranch Hand): Current Dioxin ≤ 10 ppt.

Low (Ranch Hand): Current Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 143 ppt.

High (Ranch Hand): Current Dioxin > 10 ppt, Initial Dioxin > 143 ppt.

**Table P-3-6. (Continued)**  
**Analysis of FVC (Percent of Predicted)**  
**Occupation and Body Fat Removed from Final Model**

c) MODELS 4, 5, AND 6: RANCH HANDS — CURRENT DIOXIN — ADJUSTED							
Model <sup>a</sup>	Current Dioxin Category Adjusted Mean/(n)			Analysis Results for Log <sub>2</sub> (Current Dioxin + 1)			
	Low	Medium	High	R <sup>2</sup>	Adj. Slope (Std. Error)	p-Value	Covariate Remarks
4	95.6 (294)	94.9 (299)	92.8 (299)	0.117	-1.222 (0.317)	<0.001	AGE (p=0.001) CSMOK (p=0.031) PACKYR*RACE (p=0.037) PACKYR*IC (p=0.011)
5	96.9 (299)	94.6 (296)	92.5 (297)	0.118	-1.066 (0.271)	<0.001	AGE (p=0.001) CSMOK (p=0.032) PACKYR*RACE (p=0.040) PACKYR*IC (p=0.011)
6 <sup>b</sup>	96.4 (298)	94.5 (296)	92.8 (297)	0.120	-0.915 (0.294)	0.002	AGE (p=0.001) CSMOK (p=0.041) PACKYR*RACE (p=0.046) PACKYR*IC (p=0.011)

<sup>a</sup> Model 4: Log<sub>2</sub> (lipid-adjusted current dioxin + 1).  
 Model 5: Log<sub>2</sub> (whole-weight current dioxin + 1).  
 Model 6: Log<sub>2</sub> (whole-weight current dioxin + 1), adjusted for log<sub>2</sub> total lipids.

<sup>b</sup> Adjusted for log<sub>2</sub> total lipids in addition to covariates specified under "Covariate Remarks" column.

Note: Model 4: Low = ≤8.1 ppt; Medium = >8.1-20.5 ppt; High = >20.5 ppt.  
 Models 5 and 6: Low = ≤46 ppq; Medium = >46-128 ppq; High = >128 ppq.

**Table P-3-7.**  
**Analysis of FEV<sub>1</sub> (Percent of Predicted)**  
**Occupation and Body Fat Removed from Final Model**

<b>a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED</b>						
<b>Initial Dioxin Category Summary Statistics</b>			<b>Analysis Results for Log<sub>2</sub> (Initial Dioxin)<sup>a</sup></b>			
<b>Initial Dioxin</b>	<b>n</b>	<b>Adj. Mean<sup>a</sup></b>	<b>R<sup>2</sup></b>	<b>Adj. Slope (Std. Error)</b>	<b>p-Value</b>	<b>Covariate Remarks</b>
Low	174	****	0.150	****	****	INIT*CSMOK (p=0.002)
Medium	173	****				AGE (p<0.001)
High	173	****				RACE (p<0.001) PACKYR (p<0.001) IC (p=0.074)

<sup>a</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

\*\*\*\* Log<sub>2</sub> (initial dioxin)-by-covariate interaction (p≤0.01); adjusted mean, adjusted slope, standard error, and p-value not presented; refer to Appendix Table P-4-4 for further analysis of this interaction.

Note: Low = 39-98 ppt; Medium = >98-232 ppt; High = >232 ppt.

<b>b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED</b>					
<b>Dioxin Category</b>	<b>n</b>	<b>Adj. Mean<sup>a</sup></b>	<b>Difference of Adj. Mean vs. Comparisons (95% C.I.)</b>	<b>p-Value</b>	<b>Covariate Remarks</b>
Comparison	1,060	91.5			CSMOK (p<0.001) IC (p=0.008)
Background RH	372	91.2	-0.4 (-2.3,1.6)	0.719	AGE*PACKYR (p=0.001) PACKYR*RACE (p=0.006)
Low RH	260	91.5	-0.0 (-2.2,2.1)	0.968	
High RH	260	90.2	-1.3 (-3.5,0.8)	0.230	
Low plus High RH	520	90.9	-0.7 (-2.4,1.0)	0.424	

<sup>a</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

Note: RH = Ranch Hand.

Comparison: Current Dioxin ≤10 ppt.

Unknown (Ranch Hand): Current Dioxin ≤10 ppt.

Low (Ranch Hand): Current Dioxin >10 ppt, 10 ppt < Initial Dioxin ≤143 ppt.

High (Ranch Hand): Initial Dioxin >143 ppt.

**Table P-3-7. (Continued)**  
**Analysis of FEV<sub>1</sub> (Percent of Predicted)**  
**Occupation and Body Fat Removed from Final Model**

c) MODELS 4, 5, AND 6: RANCH HANDS — CURRENT DIOXIN — ADJUSTED							
Model <sup>a</sup>	Current Dioxin Category Adjusted Mean/(n)			Analysis Results for Log <sub>2</sub> (Current Dioxin + 1)			
	Low	Medium	High	R <sup>2</sup>	Adj. Slope (Std. Error)	p-Value	Covariate Remarks
4	90.0 (294)	90.4 (299)	88.5 (299)	0.160	-0.337 (0.385)	0.382	AGE (p<0.001) RACE (p<0.001) CSMOK (p<0.001) PACKYR (p<0.001) IC (p=0.031)
5	90.3 (299)	90.0 (296)	88.8 (297)	0.160	-0.313 (0.328)	0.340	AGE (p<0.001) RACE (p<0.001) CSMOK (p<0.001) PACKYR (p<0.001) IC (p=0.031)
6 <sup>b</sup>	89.9 (298)	89.8 (296)	89.1 (297)	0.161	-0.161 (0.357)	0.653	AGE (p<0.001) RACE (p<0.001) CSMOK (p<0.001) PACKYR (p<0.001) IC (p=0.030)

<sup>a</sup> Model 4: Log<sub>2</sub> (lipid-adjusted current dioxin + 1).  
 Model 5: Log<sub>2</sub> (whole-weight current dioxin + 1).  
 Model 6: Log<sub>2</sub> (whole-weight current dioxin + 1), adjusted for log<sub>2</sub> total lipids.

<sup>b</sup> Adjusted for log<sub>2</sub> total lipids in addition to covariates specified under "Covariate Remarks" column.

Note: Model 4: Low = ≤8.1 ppt; Medium = >8.1-20.5 ppt; High = >20.5 ppt.  
 Models 5 and 6: Low = ≤46 ppq; Medium = >46-128 ppq; High = >128 ppq.

**Table P-3-8.**  
**Analysis of Ratio of Observed FEV<sub>1</sub> to Observed FVC**  
**Occupation and Body Fat Removed from Final Model**

a) MODEL 2: RANCH HANDS -- INITIAL DIOXIN -- ADJUSTED						
Initial Dioxin Category Summary Statistics			Analysis Results for Log <sub>2</sub> (Initial Dioxin) <sup>b</sup>			
Initial Dioxin	n	Adj. Mean <sup>ab</sup>	R <sup>2</sup>	Adj. Slope (Std. Error) <sup>c</sup>	p-Value	Covariate Remarks
Low	174	0.783	0.195	-0.013 (0.011)	0.208	AGE (p<0.001)
Medium	173	0.780				RACE (p=0.004)
High	173	0.798				CSMOK (p=0.134) PACKYR (p<0.001) IC (p=0.043)

<sup>a</sup> Transformed from natural logarithm (1-X) scale.

<sup>b</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

<sup>c</sup> Slope and standard error based on natural logarithm of (1-ratio of observed FEV<sub>1</sub> to observed FVC) versus log<sub>2</sub> (initial dioxin).

Note: Low = 39-98 ppt; Medium = >98-232 ppt; High = >232 ppt.

**Table P-3-8. (Continued)**  
**Analysis of Ratio of Observed FEV<sub>1</sub> to Observed FVC**  
**Occupation and Body Fat Removed from Final Model**

<b>b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED</b>					
<b>Dioxin Category</b>	<b>n</b>	<b>Adj. Mean<sup>ab</sup></b>	<b>Difference of Adj. Mean vs. Comparisons (95% C.I.)<sup>c</sup></b>	<b>p-Value<sup>d</sup></b>	<b>Covariate Remarks</b>
Comparison	1,060	0.776			AGE (p < 0.001) PACKYR (p < 0.001) IC (p = 0.005) CSMOK*RACE (p = 0.008)
Background RH	372	0.769	-0.007 --	0.062	
Low RH	260	0.779	0.003 --	0.502	
High RH	260	0.780	0.004 --	0.377	
Low plus High RH	520	0.779	0.003 --	0.314	

<sup>a</sup> Transformed from natural logarithm (1-X) scale.

<sup>b</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

<sup>c</sup> Difference of adjusted means after transformation to original scale; confidence interval on difference of adjusted means not presented because analysis was performed on natural logarithm (1-X) scale.

<sup>d</sup> P-value is based on difference of means on natural logarithm (1-X) scale.

Note: RH = Ranch Hand.

Comparison: Current Dioxin ≤ 10 ppt.

Background (Ranch Hand): Current Dioxin ≤ 10 ppt.

Low (Ranch Hand): Current Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 143 ppt.

High (Ranch Hand): Current Dioxin > 10 ppt, Initial Dioxin > 143 ppt.

**Table P-3-8. (Continued)**  
**Analysis of Ratio of Observed FEV<sub>1</sub> to Observed FVC**  
**Occupation and Body Fat Removed from Final Model**

c) MODELS 4, 5, AND 6: RANCH HANDS — CURRENT DIOXIN — ADJUSTED							
Model <sup>b</sup>	Current Dioxin Category Adjusted Mean <sup>a</sup> /(n)			Analysis Results for Log <sub>2</sub> (Current Dioxin + 1)			
	Low	Medium	High	R <sup>2</sup>	Adj. Slope (Std. Error) <sup>c</sup>	p-Value	Covariate Remarks
4	0.762 (294)	0.777 (299)	0.783 (299)	0.208	-0.033 (0.007)	<0.001	AGE (p<0.001) RACE (p=0.002) CSMOK (p<0.001) PACKYR (p<0.001) IC (p=0.019)
5	0.762 (299)	0.775 (296)	0.787 (297)	0.207	-0.027 (0.006)	<0.001	AGE (p<0.001) RACE (p=0.002) CSMOK (p<0.001) PACKYR (p<0.001) IC (p=0.021)
6 <sup>d</sup>	0.762 (298)	0.775 (296)	0.787 (297)	0.206	-0.029 (0.007)	<0.001	AGE (p<0.001) RACE (p=0.002) CSMOK (p<0.001) PACKYR (p<0.001) IC (p=0.020)

<sup>a</sup> Transformed from natural logarithm (1-X) scale.

<sup>b</sup> Model 4: Log<sub>2</sub> (lipid-adjusted current dioxin + 1).  
 Model 5: Log<sub>2</sub> (whole-weight current dioxin + 1).  
 Model 6: Log<sub>2</sub> (whole-weight current dioxin + 1), adjusted for log<sub>2</sub> total lipids.

<sup>c</sup> Slope and standard error based on natural logarithm of (1-ratio of observed FEV<sub>1</sub> to observed FVC) versus log<sub>2</sub> (current dioxin + 1).

<sup>d</sup> Adjusted for log<sub>2</sub> total lipids in addition to covariates specified under "Covariate Remarks" column.

Note: Model 4: Low = ≤8.1 ppt; Medium = >8.1-20.5 ppt; High = >20.5 ppt.  
 Models 5 and 6: Low = ≤46 ppq; Medium = >46-128 ppq; High = >128 ppq.

**Table P-3-9.  
Analysis of Loss of Vital Capacity  
Occupation and Body Fat Removed from Final Model**

a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED					
Analysis Results for Log <sub>e</sub> (Initial Dioxin) <sup>a</sup>					
n	Mild vs. None		Moderate or Severe vs. None		Covariate Remarks
	Adj. Relative Risk (95% C.I.) <sup>b</sup>	p-Value	Adj. Relative Risk (95% C.I.) <sup>b</sup>	p-Value	
520	1.13 (0.85,1.51)	0.407	0.87 (0.43,1.75)	0.690	AGE (p=0.018) RACE*PACKYR (p=0.012) IC (p=0.542)

<sup>a</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

<sup>b</sup> Relative risk for a twofold increase in initial dioxin.

**Table P-3-9. (Continued)**  
**Analysis of Loss of Vital Capacity**  
**Occupation and Body Fat Removed from Final Model**

<b>b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED</b>						
<b>Dioxin Category</b>	<b>n</b>	<b>Mild vs. None</b>		<b>Moderate or Severe vs. None</b>		<b>Covariate Remarks</b>
		<b>Adj. Relative Risk (95% C.I.)<sup>ab</sup></b>	<b>p-Value</b>	<b>Adj. Relative Risk (95% C.I.)<sup>ab</sup></b>	<b>p-Value</b>	
Comparison	1,060					AGE (p<0.001) CSMOK (p=0.018) IC (p=0.135) RACE*PACKYR (p=0.002)
Background RH	372	0.95 (0.55,1.62)	0.841	0.43 (0.10,1.94)	0.274	
Low RH	260	0.67 (0.36,1.24)	0.198	0.99 (0.35,2.83)	0.986	
High RH	260	0.82 (0.45,1.50)	0.522	0.72 (0.20,2.61)	0.621	
Low plus High RH	520	0.74 (0.46,1.18)	0.205	0.87 (0.36,2.11)	0.760	

<sup>a</sup> Relative risk and confidence interval relative to Comparisons.

<sup>b</sup> Adjusted for percent body fat at the time of duty in SEA, change in body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

Note: RH = Ranch Hand.

Comparison: Current Dioxin ≤ 10 ppt.

Background (Ranch Hand): Current Dioxin ≤ 10 ppt.

Low (Ranch Hand): Current Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 143 ppt.

High (Ranch Hand): Current Dioxin > 10 ppt, Initial Dioxin > 143 ppt.

**Table P-3-9. (Continued)**  
**Analysis of Loss of Vital Capacity**  
**Occupation and Body Fat Removed from Final Model**

c) MODELS 4, 5, AND 6: RANCH HANDS — CURRENT DIOXIN — ADJUSTED						
Model <sup>a</sup>	n	Analysis Results for Log <sub>2</sub> (Current Dioxin + 1)				Covariate Remarks
		Mild vs. None		Moderate or Severe vs. None		
		Adj. Relative Risk (95% C.I.) <sup>b</sup>	p-Value	Adj. Relative Risk (95% C.I.) <sup>b</sup>	p-Value	
4	892	1.22 (1.00,1.50)**	0.056**	1.16 (0.71,1.91)**	0.551**	CURR*RACE (p=0.023) CURR*CSMOK (p=0.011) AGE (p=0.003) RACE*PACKYR (p=0.043)
5	892	1.21 (1.01,1.44)**	0.039**	1.15 (0.75,1.77)**	0.527**	CURR*CSMOK (p=0.032) RACE*PACKYR (p=0.058) AGE (p=0.003)
6 <sup>c</sup>	891	1.24 (1.02,1.49)	0.029	1.22 (0.77,1.93)	0.398	AGE (p=0.012) CSMOK (p=0.120) RACE*PACKYR (p=0.042)

<sup>a</sup> Model 4: Log<sub>2</sub> (lipid-adjusted current dioxin + 1).  
 Model 5: Log<sub>2</sub> (whole-weight current dioxin + 1).  
 Model 6: Log<sub>2</sub> (whole-weight current dioxin + 1), adjusted for log<sub>2</sub> total lipids.

<sup>b</sup> Relative risk for a twofold increase in current dioxin.

<sup>c</sup> Adjusted for log<sub>2</sub> total lipids in addition to covariates specified under "Covariate Remarks" column.

\*\* Log<sub>2</sub> (current dioxin + 1)-by-covariate interaction (0.01 < p ≤ 0.05); adjusted relative risk, confidence interval, and p-value derived from a model after deletion of this interaction; refer to Appendix Table P-4-5 for further analysis of this interaction.

**Table P-3-10.**  
**Analysis of Obstructive Abnormality**  
**Occupation and Body Fat Removed from Final Model**

<b>a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED</b>					
<b>Analysis Results for Log<sub>2</sub> (Initial Dioxin)<sup>a</sup></b>					
<b>n</b>	<b>Mild vs. None</b>		<b>Moderate or Severe vs. None</b>		<b>Covariate Remarks</b>
	<b>Adj. Relative Risk (95% C.I.)<sup>b</sup></b>	<b>p-Value</b>	<b>Adj. Relative Risk (95% C.I.)<sup>b</sup></b>	<b>p-Value</b>	
520	0.98 (0.83,1.16)	0.814	0.92 (0.67,1.26)	0.599	CSMOK (p=0.409) IC (p=0.006) AGE*PACKYR (p=0.036)

<sup>a</sup> Adjusted for percent body fat at the time of duty in SEA, change in percent body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

<sup>b</sup> Relative risk for a twofold increase in initial dioxin.

**Table P-3-10. (Continued)**  
**Analysis of Obstructive Abnormality**  
**Occupation and Body Fat Removed from Final Model**

<b>b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED</b>						
<b>Dioxin Category</b>	<b>n</b>	<b>Mild vs. None</b>		<b>Moderate or Severe vs. None</b>		<b>Covariate Remarks</b>
		<b>Adj. Relative Risk (95% C.I.)<sup>ab</sup></b>	<b>p-Value</b>	<b>Adj. Relative Risk (95% C.I.)<sup>ab</sup></b>	<b>p-Value</b>	
Comparison	1,060					DXCAT*PACKYR (p=0.037) AGE (p<0.001) CSMOK (p<0.001) IC (p=0.005)
Background RH	372	1.15 (0.87,1.51)**	0.315**	1.24 (0.77,2.02)**	0.378**	
Low RH	260	0.96 (0.70,1.31)**	0.782**	1.14 (0.66,1.97)**	0.642**	
High RH	260	1.00 (0.72,1.39)**	0.999**	0.90 (0.47,1.72)**	0.753**	
Low plus High RH	520	0.98 (0.76,1.25)**	0.853**	1.04 (0.66,1.64)**	0.880**	

<sup>a</sup> Relative risk and confidence interval relative to Comparisons.

<sup>b</sup> Adjusted for percent body fat at the time of duty in SEA, change in body fat from the time of duty in SEA to the date of the blood draw for dioxin, and covariates specified under "Covariate Remarks" column.

\*\* Categorized dioxin-by-covariate interaction (0.01 < p ≤ 0.05); adjusted relative risk, confidence interval, and p-value derived from a model after deletion of this interaction; refer to Appendix Table P-4-6 for further analysis of this interaction.

Note: RH = Ranch Hand.

Comparison: Current Dioxin ≤ 10 ppt.

Background (Ranch Hand): Current Dioxin ≤ 10 ppt.

Low (Ranch Hand): Current Dioxin > 10 ppt, 10 ppt < Initial Dioxin ≤ 143 ppt.

High (Ranch Hand): Current Dioxin > 10 ppt, Initial Dioxin > 143 ppt.

**Table P-3-10. (Continued)**  
**Analysis of Obstructive Abnormality**  
**Occupation and Body Fat Removed from Final Model**

c) MODELS 4, 5, AND 6: RANCH HANDS — CURRENT DIOXIN — ADJUSTED						
Model <sup>a</sup>	Analysis Results for Log <sub>2</sub> (Current Dioxin + 1)					
	n	Mild vs. None		Moderate or Severe vs. None		Covariate Remarks
		Adj. Relative Risk (95% C.I.) <sup>b</sup>	p-Value	Adj. Relative Risk (95% C.I.) <sup>b</sup>	p-Value	
4	892	0.86 (0.77,0.97)	0.011	0.84 (0.68,1.03)	0.096	AGE (p<0.001) CSMOK (p=0.001) PACKYR (p<0.001) RACE*IC (p=0.017)
5	892	0.89 (0.81,0.98)	0.022	0.87 (0.73,1.03)	0.097	AGE (p<0.001) CSMOK (p=0.001) PACKYR (p<0.001) RACE*IC (p=0.017)
6 <sup>c</sup>	891	0.90 (0.81,1.00)	0.050	0.91 (0.76,1.08)	0.282	AGE (p<0.001) CSMOK (p=0.001) PACKYR (p<0.001) RACE*IC (p=0.017)

<sup>a</sup> Model 4: Log<sub>2</sub> (lipid-adjusted current dioxin + 1).  
 Model 5: Log<sub>2</sub> (whole-weight current dioxin + 1).  
 Model 6: Log<sub>2</sub> (whole-weight current dioxin + 1), adjusted for log<sub>2</sub> total lipids.

<sup>b</sup> Relative risk for a twofold increase in current dioxin.

<sup>c</sup> Adjusted for log<sub>2</sub> total lipids in addition to covariates specified under "Covariate Remarks" column.