

APPENDIX O-3.

Immunology Analysis Tables Occupation Removed from Final Model

This appendix contains results of exposure analyses after occupation has been removed from those final dioxin models (Models 2 through 6) that contained occupation. These analyses are performed to investigate the relationship of the dependent variable to dioxin without removing any effects due to occupation. The format of these tables closely parallels the adjusted panels of Chapter 19 tables. A summary of the tables found in this appendix follows.

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**Table O-3-1.
Analysis of Composite Skin Test Diagnosis
Occupation Removed from Final Model**

a) MODEL 6: RANCH HANDS — CURRENT DIOXIN — ADJUSTED				
Analysis Results for Log₂ (Current Dioxin + 1)				
Model^a	n	Adj. Relative Risk (95% C.I.)^b	p-Value	Covariate Remarks
6 ^c	863	0.82 (0.67,1.01)	0.062	AGE (p=0.041) RACE (p=0.048) CSMOK (p=0.078)

^a Log₂ (whole-weight current dioxin + 1), adjusted for log₂ total lipids.

^b Relative risk for a twofold increase in current dioxin.

^c Adjusted for log₂ total lipids in addition to covariates specified under "Covariate Remarks" column.

**Table O-3-2.
Analysis of CD3 Cells (cells/mm³)
Occupation Removed from Final Model**

a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED						
Initial Dioxin Category Summary Statistics			Analysis Results for Log₂ (Initial Dioxin)^a			
Initial Dioxin	n	Adj. Mean^{ab}	R²	Adj. Slope (Std. Error)^c	p-Value	Covariate Remarks
Low	64	1,517.8	0.526	-0.017 (0.029)	0.566	AGE (p=0.393) CSMOK (p=0.004) DRKYR (p=0.151)
Medium	65	1,567.4				
High	71	1,473.0				

^a Transformed from natural logarithm scale.

^b 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, examination group (batch-to-batch) variation, and covariates specified under "Covariate Remarks" column.

^c Slope and standard error based on natural logarithm of CD3 cells versus log₂ (initial dioxin).

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

b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED					
Dioxin Category	n	Adj. Mean^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.)^c	p-Value^d	Covariate Remarks
Comparison	400	1,441.0**			DXCAT*AGE (p=0.024) CSMOK (p<0.001) ALC (p=0.115)
Background RH	140	1,501.9**	60.9 --**	0.294**	
Low RH	95	1,417.1**	-23.9 --**	0.718**	
High RH	106	1,487.9**	46.9 --**	0.463**	
Low plus High RH	201	1,454.0**	13.0 --**	0.790**	

^a Transformed from natural logarithm scale.

^b 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, examination group (batch-to-batch) variation, and covariates specified under "Covariate Remarks" column.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm scale.

**Categorized dioxin-by-covariate interaction (0.01 < p ≤ 0.05); adjusted mean, difference of adjusted means, confidence interval, and p-value derived from a model fitted after deletion of this interaction; refer to Appendix Table O-4-1 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 O-3-3.
Analysis of CD4 Cells (cells/mm³)
Occupation Removed from Final Model

a) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED					
Dioxin Category	n	Adj. Mean^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.)^c	p-Value^d	Covariate Remarks
Comparison	403	920.6**			DXCAT*AGE (p=0.046) CSMOK (p<0.001)
Background RH	141	966.9**	46.3 --**	0.220**	
Low RH	95	915.5**	-5.1 --**	0.906**	
High RH	108	953.3**	32.7 --**	0.427**	
Low plus High RH	203	935.4**	14.8 --**	0.647**	

^a Transformed from natural logarithm scale.

^b 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, examination group (batch-to-batch) variation, and covariates specified under "Covariate Remarks" column.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm scale.

** Categorized dioxin-by-covariate interaction ($0.01 < p \leq 0.05$); adjusted mean, difference of adjusted means, confidence interval, and p-value derived from a model fitted after deletion of this interaction; refer to Appendix Table O-4-2 for further analysis of this interaction.

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 O-3-4.
Analysis of CD5 Cells (cells/mm³)
Occupation Removed from Final Model

a) MODEL 2: RANCH HANDS – INITIAL DIOXIN – ADJUSTED						
Initial Dioxin Category Summary Statistics			Analysis Results for Log₂ (Initial Dioxin)^a			
Initial Dioxin	n	Adj. Mean^{ab}	R²	Adj. Slope (Std. Error)^c	p-Value	Covariate Remarks
Low	64	1,573.5	0.526	-0.015 (0.030)	0.623	AGE (p=0.285)
Medium	65	1,631.5				CSMOK (p=0.009)
High	71	1,526.2				DRKYR (p=0.141)

^a Transformed from natural logarithm scale.

^b 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, examination group (batch-to-batch) variation, and covariates specified under "Covariate Remarks" column.

^c Slope and standard error based on natural logarithm of CD5 cells versus log₂ (initial dioxin).

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

b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY – ADJUSTED					
Dioxin Category	n	Adj. Mean^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.)^c	p-Value^d	Covariate Remarks
Comparison	400	1,481.2**			DXCAT*AGE (p=0.016) CSMOK (p<0.001) ALC (p=0.076)
Background RH	140	1,544.1**	62.9 --**	0.293**	
Low RH	95	1,461.1**	-20.1 --**	0.769**	
High RH	106	1,544.0**	62.8 --**	0.344**	
Low plus High RH	201	1,504.2**	23.0 --**	0.657**	

^a Transformed from natural logarithm scale.

^b 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, examination group (batch-to-batch) variation, and covariates specified under "Covariate Remarks" column.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm scale.

** Categorized dioxin-by-covariate interaction (0.01 < p ≤ 0.05); adjusted mean, difference of adjusted means, confidence interval, and p-value derived from a model fitted after deletion of this interaction; refer to Appendix Table O-4-3 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 O-3-5.
Analysis of CD8 Cells (cells/mm³)
Occupation Removed from Final Model

a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED						
Initial Dioxin Category Summary Statistics			Analysis Results for Log₂ (Initial Dioxin)^a			
Initial Dioxin	n	Adj. Mean^{ab}	R²	Adj. Slope (Std. Error)^c	p-Value	Covariate Remarks
Low	64	615.7	0.055	-0.008 (0.027)	0.761	CSMOK (p=0.006) ALC (p=0.028)
Medium	66	610.9				
High	71	616.1				

^a Transformed from natural logarithm scale.

^b 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.

^c Slope and standard error based on natural logarithm of CD8 cells versus log₂ (initial dioxin).

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

b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED					
Dioxin Category	n	Adj. Mean^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.)^c	p-Value^d	Covariate Remarks
Comparison	400	631.6			AGE (p=0.264) CSMOK (p<0.001) ALC (p=0.051)
Background RH	140	634.8	3.2 --	0.914	
Low RH	95	605.5	-26.1 --	0.430	
High RH	106	622.0	-9.6 --	0.765	
Low plus High RH	201	614.1	-17.5 --	0.485	

^a Transformed from natural logarithm scale.

^b 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.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm 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 O-3-5. (Continued)
Analysis of CD8 Cells (cells/mm³)
Occupation Removed from Final Model

b) MODEL 4: RANCH HANDS — CURRENT DIOXIN — ADJUSTED							
Model ^b	Current Dioxin Category Adjusted Mean ^a /(n)			Analysis Results for Log ₂ (Current Dioxin + 1)			
	Low	Medium	High	R ²	Adj. Slope (Std. Error) ^c	p-Value	Covariate Remarks
4	622.9 (115)	659.0 (107)	590.8 (119)	0.048	-0.008 (0.018)	0.679	CSMOK (p < 0.001) ALC (p = 0.140)

^a Transformed from natural logarithm scale.

^b Log₂ (lipid-adjusted current dioxin + 1).

^c Slope and standard error based on natural logarithm of CD8 cells versus log₂ (current dioxin + 1).

Note: Low = ≤ 8.1 ppt; Medium = >8.1-20.5 ppt; High = >20.5 ppt.

**Table O-3-6.
Analysis of CD14 Cells (cells/mm³)
Occupation Removed from Final Model**

a) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED					
Dioxin Category	n	Adj. Mean^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.)^c	p-Value^d	Covariate Remarks
Comparison	403	****			DXCAT*AGE (p=0.001) RACE (p=0.016) CSMOK (p<0.001) PHYACT (p=0.113)
Background RH	141	****	****	****	
Low RH	95	****	****	****	
High RH	108	****	****	****	
Low plus High RH	203	****	****	****	

^a Transformed from natural logarithm scale.

^b 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, examination group (batch-to-batch) variation, and covariates specified under "Covariate Remarks" column.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm scale.

**** Categorized dioxin-by-covariate interaction ($p \leq 0.01$); adjusted mean, difference of adjusted means, confidence interval, and p-value not presented; refer to Appendix Table O-4-4 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 O-3-6. (Continued)
Analysis of CD14 Cells (cells/mm³)
Occupation Removed from Final Model

b) MODELS 4, 5, AND 6: RANCH HANDS — CURRENT DIOXIN — ADJUSTED							
Model ^c	Current Dioxin Category Adjusted Mean ^{ab} /(n)			Analysis Results for Log ₂ (Current Dioxin + 1)			
	Low	Medium	High	R ²	Adj. Slope (Std. Error) ^d	p-Value	Covariate Remarks
4	476.5 (116)	453.5 (107)	466.4 (121)	0.331	0.003 (0.014)	0.818	AGE (p=0.098) RACE (p=0.015) CSMOK (p<0.001)
5	479.2 (112)	439.0 (116)	486.9 (116)	0.332	0.007 (0.012)	0.556	AGE (p=0.081) RACE (p=0.015) CSMOK (p<0.001)
6 ^e	493.2 (112)	444.0 (116)	482.7 (116)	0.341	-0.003 (0.013)	0.819	AGE (p=0.117) RACE (p=0.026) CSMOK (p<0.001)

^a Transformed from natural logarithm scale.

^b Adjusted for examination group (batch-to-batch) variation and covariates specified under "Covariate Remarks" column.

^c Model 4: Log₂ (lipid-adjusted current dioxin + 1).
 Model 5: Log₂ (whole-weight current dioxin + 1).
 Model 6: Log₂ (whole-weight current dioxin + 1), adjusted for log₂ total lipids.

^d Slope and standard error based on natural logarithm of CD14 cells versus log₂ (current dioxin + 1).

^e Adjusted for log₂ 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 O-3-7.
Analysis of CD16 + 56 Cells (cells/mm³)
Occupation Removed from Final Model

a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED						
Initial Dioxin Category Summary Statistics			Analysis Results for Log ₂ (Initial Dioxin) ^a			
Initial Dioxin	n	Adj. Mean ^{ab}	R ²	Adj. Slope (Std. Error) ^c	p-Value	Covariate Remarks
Low	64	244.2	0.436	-0.001 (0.042)	0.983	CSMOK (p=0.117) PHYACT (p=0.173)
Medium	67	238.4				
High	72	243.0				

^a Transformed from natural logarithm scale.

^b 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.

^c Slope and standard error based on natural logarithm of CD16 + 56 cells versus log₂ (initial dioxin).

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

b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED					
Dioxin Category	n	Adj. Mean ^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.) ^c	p-Value ^d	Covariate Remarks
Comparison	399	250.3**			DXCAT*DRKYR (p=0.042) AGE (p=0.003) RACE (p=0.219) CSMOK (p=0.008) PHYACT (p=0.833)
Background RH	139	241.0**	-9.3 --**	0.496**	
Low RH	94	221.1**	-29.2 --**	0.060**	
High RH	106	241.4**	-8.9 --**	0.561**	
Low plus High RH	200	231.7**	-18.6 --**	0.115**	

^a Transformed from natural logarithm scale.

^b 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, examination group (batch-to-batch) variation, and covariates specified under "Covariate Remarks" column.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm scale.

** Categorized dioxin-by-covariate interaction (0.01 < p ≤ 0.05); adjusted mean, difference of adjusted means, confidence interval, and p-value derived from a model fitted after deletion of this interaction; refer to Appendix Table O-4-5 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 O-3-8.
Analysis of CD20 Cells (cells/mm³)
Occupation Removed from Final Model**

a) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED					
Dioxin Category	n	Adj. Mean^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.)^c	p-Value^d	Covariate Remarks
Comparison	400	211.8			AGE (p < 0.001) CSMOK (p < 0.001) ALC (p = 0.006)
Background RH	140	235.3	23.5 --	0.046	
Low RH	95	222.9	11.1 --	0.402	
High RH	106	222.3	10.5 --	0.410	
Low plus High RH	201	222.6	10.8 --	0.279	

^a Transformed from natural logarithm (X + 1) scale.

^b 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.

^c 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 (X + 1) scale.

^d P-value is based on difference of means on natural logarithm (X + 1) 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 O-3-9.
Analysis of CD25 Cells (cells/mm³)
Occupation Removed from Final Model**

a) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED					
Dioxin Category	n	Adj. Mean^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.)^c	p-Value^d	Covariate Remarks
Comparison	399	269.3**			DXCAT*AGE (p=0.032) DXCAT*PACKYR (p=0.030)
Background RH	139	277.0**	7.7 --	0.550**	DXCAT*DRKYR (p=0.041)
Low RH	94	267.7**	1.6 --	0.914**	RACE (p=0.046)
High RH	106	271.8**	2.5 --	0.862**	CSMOK (p < 0.001)
Low plus High RH	200	269.9**	0.6 --	0.961**	

^a Transformed from natural logarithm scale.

^b 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, examination group (batch-to-batch) variation, and covariates specified under "Covariate Remarks" column.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm scale.

** Categorized dioxin-by-covariate interactions (0.01 < p ≤ 0.05); adjusted mean, difference of adjusted means, confidence interval, and p-value derived from a model fitted after deletion of these interactions; refer to Appendix Table O-4-6 for further analysis of these interactions.

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 O-3-10.
Analysis of CD4-CD8 Ratio
Occupation Removed from Final Model

a) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED					
Dioxin Category	n	Adj. Mean^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.)^c	p-Value^d	Covariate Remarks
Comparison	399	1.480			AGE (p=0.008) CSMOK (p=0.005) DRKYR (p=0.071)
Background RH	139	1.538	0.058 --	0.360	
Low RH	94	1.576	0.096 --	0.191	
High RH	106	1.540	0.060 --	0.390	
Low plus High RH	200	1.557	0.077 --	0.161	

^a Transformed from natural logarithm scale.

^b 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.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm scale.

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 O-3-11.
Analysis of Double Labelled Cells: CD3 with CD25 (cells/mm³)
Occupation Removed from Final Model

a) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED					
Dioxin Category	n	Adj. Mean ^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.) ^c	p-Value ^d	Covariate Remarks
Comparison	399	215.7**			DXCAT*PACKYR (p=0.023)
Background RH	139	221.2**	5.5 --**	0.612**	DXCAT*DRKYR (p=0.018)
Low RH	94	212.8**	-2.9 --**	0.818**	RACE (p=0.022)
High RH	106	221.2**	5.5 --**	0.651**	CSMOK (p<0.001)
Low plus High RH	200	217.2**	1.5 --**	0.877**	

^a Transformed from natural logarithm scale.

^b 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, examination group (batch-to-batch) variation, and covariates specified under "Covariate Remarks" column.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm scale.

** Categorized dioxin-by-covariate interactions ($0.01 < p \leq 0.05$); adjusted mean, difference of adjusted means, confidence interval, and p-value derived from a model fitted after deletion of these interactions; refer to Appendix Table O-4-7 for further analysis of these interactions.

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 O-3-12.
Analysis of Double Labelled Cells: CD4 with CD8 (cells/mm³)
Occupation Removed from Final Model

a) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED					
Dioxin Category	n	Adj. Mean^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.)^c	p-Value^d	Covariate Remarks
Comparison	360	****			DXCAT*AGE (p=0.006) RACE (p=0.059) CSMOK (p<0.001) PACKYR (p=0.046)
Background RH	126	****	****	****	
Low RH	85	****	****	****	
High RH	95	****	****	****	
Low plus High RH	180	****	****	****	

^a Transformed from natural logarithm scale.

^b 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.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm scale.

**** Categorized dioxin-by-covariate interaction (p≤0.01); adjusted mean, difference of adjusted means, confidence interval, and p-value not presented; refer to Appendix Table O-4-8 for further analysis of this interaction.

Note: Analysis based on measurements above 0 cells/mm³ only.

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 O-3-13.
Analysis of Double Labelled Cells: CD3 with CD16+56 (Zero vs. Nonzero)
Occupation Removed from Final Model

a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED			
Analysis Results for Log₂ (Initial Dioxin)^a			
n	Adj. Relative Risk (95% C.I.)^b	p-Value	Covariate Remarks
203	1.52 (0.86,2.68)	0.147	PHYACT (p=0.158)

^a 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.

^b Relative risk for a twofold increase in initial dioxin.

Table O-3-13. (Continued)
Analysis of Double Labelled Cells: CD3 with CD16+56 (Nonzero Measurements)
Occupation Removed from Final Model

b) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED						
Initial Dioxin Category Summary Statistics			Analysis Results for Log ₂ (Initial Dioxin) ^b			
Initial Dioxin	n	Adj. Mean ^{ab}	R ²	Adj. Slope (Std. Error) ^c	p-Value	Covariate Remarks
Low	62	118.0	0.499	-0.211 (0.072)	0.004	RACE (p=0.126)
Medium	64	104.3				CSMOK (p=0.039)
High	65	68.6				PACKYR (p=0.051) DRKYR (p=0.024)

^a Transformed from natural logarithm scale.

^b 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.

^c Slope and standard error based on natural logarithm of CD3 with CD16+56 versus log₂ (initial dioxin).

Note: Analysis based on measurements above 0 cells/mm³ only.
 Low = 39-98 ppt; Medium = >98-232 ppt; High = >232 ppt.

**Table O-3-14.
Analysis of IgA (mg/dl)
Occupation Removed from Final Model**

a) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED					
Dioxin Category	n	Adj. Mean^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.)^c	p-Value^d	Covariate Remarks
Comparison	1,051	231.2**			DXCAT*RACE (p=0.030) AGE (p=0.004)
Background RH	367	226.2**	-5.0 --**	0.429**	
Low RH	256	224.3**	-6.9 --**	0.336**	
High RH	255	233.7**	2.5 --**	0.740**	
Low plus High RH	511	228.9**	-2.3 --**	0.687**	

^a Transformed from natural logarithm scale.

^b 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.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm scale.

** Categorized dioxin-by-covariate interaction ($0.01 < p \leq 0.05$); adjusted mean, difference of adjusted means, confidence interval, and p-value derived from a model fitted after deletion of this interaction; refer to Appendix Table O-4-9 for further analysis of this interaction.

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 O-3-14. (Continued)
Analysis of IgA (mg/dl)
Occupation Removed from Final Model

b) MODELS 4, 5, AND 6: RANCH HANDS – CURRENT DIOXIN – ADJUSTED							
Model^b	Current Dioxin Category Adjusted Mean^a/(n)			Analysis Results for Log₂ (Current Dioxin + 1)			
	Low	Medium	High	R²	Adj. Slope (Std. Error)^c	p-Value	Covariate Remarks
4	229.3 (289)	231.5 (295)	242.9 (294)	0.019	0.020 (0.011)	0.062	AGE (p=0.002) RACE (p=0.010)
5	229.5 (294)	235.9 (292)	237.5 (292)	0.017	0.012 (0.009)	0.191	AGE (p=0.003) RACE (p=0.010)
6 ^d	225.3 (292)	235.0 (292)	240.8 (292)	0.027	0.024 (0.010)	0.019	AGE (p=0.005) RACE (p=0.011) PACKYR (p=0.050)

^a Transformed from natural logarithm scale.

^b Model 4: Log₂ (lipid-adjusted current dioxin + 1).

Model 5: Log₂ (whole-weight current dioxin + 1).

Model 6: Log₂ (whole-weight current dioxin + 1), adjusted for log₂ total lipids.

^c Slope and standard error based on natural logarithm of IgA versus log₂ (current dioxin + 1).

^d Adjusted for log₂ 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 O-3-15.
Analysis of IgG (mg/dl)
Occupation Removed from Final Model**

a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED						
Initial Dioxin Category Summary Statistics			Analysis Results for Log₂ (Initial Dioxin)^a			
Initial Dioxin	n	Adj. Mean^{ab}	R²	Adj. Slope (Std. Error)^c	p-Value	Covariate Remarks
Low	169	1,139.3	0.099	0.010 (0.008)	0.236	RACE (p<0.001)
Medium	169	1,167.4				CSMOK (p=0.004)
High	166	1,150.2				ALC (p=0.007)

^a Transformed from natural logarithm scale.

^b 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.

^c Slope and standard error based on natural logarithm of IgG versus log₂ (initial dioxin).

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

b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED					
Dioxin Category	n	Adj. Mean^{ab}	Difference of Adj. Mean vs. Comparisons (95% C.I.)^c	p-Value^d	Covariate Remarks
Comparison	1,035	1,146.0			AGE (p=0.553) RACE (p<0.001) CSMOK (p<0.001) PACKYR (p=0.189) ALC (p=0.071)
Background RH	364	1,127.6	-18.4 --	0.231	
Low RH	253	1,116.9	-29.1 --	0.096	
High RH	251	1,131.0	-15.0 --	0.399	
Low plus High RH	504	1,123.9	-22.1 --	0.104	

^a Transformed from natural logarithm scale.

^b 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.

^c 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 scale.

^d P-value is based on difference of means on natural logarithm 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 O-3-15. (Continued)
Analysis of IgG (mg/dl)
Occupation Removed from Final Model

c) MODELS 4, 5, AND 6: RANCH HANDS – CURRENT DIOXIN – ADJUSTED								
Model ^b	Current Dioxin Category Adjusted Mean ^a /(n)			Analysis Results for Log ₂ (Current Dioxin + 1)				
	Low	Medium	High	R ²	Adj. Slope (Std. Error) ^c	p-Value	Covariate Remarks	
4	1,138.0 (288)	1,120.4 (292)	1,155.8 (289)	0.078	0.002 (0.005)	0.660	RACE (p<0.001) CSMOK (p<0.001) ALC (p=0.012)	
5	1,141.4 (292)	1,127.2 (290)	1,145.6 (287)	0.078	-0.001 (0.005)	0.787	RACE (p<0.001) CSMOK (p<0.001) ALC (p=0.011)	
6 ^d	1,127.9 (291)	1,123.0 (290)	1,152.3 (287)	0.084	0.003 (0.005)	0.538	RACE (p<0.001) CSMOK (p<0.001) ALC (p=0.018)	

^a Transformed from natural logarithm scale.

^b Model 4: Log₂ (lipid-adjusted current dioxin + 1).

Model 5: Log₂ (whole-weight current dioxin + 1).

Model 6: Log₂ (whole-weight current dioxin + 1), adjusted for log₂ total lipids.

^c Slope and standard error based on natural logarithm of IgG versus log₂ (current dioxin + 1).

^d Adjusted for log₂ 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 O-3-16.
Analysis of IgM (mg/dl)
Occupation Removed from Final Model

a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED						
Initial Dioxin Category Summary Statistics			Analysis Results for Log ₂ (Initial Dioxin) ^b			
Initial Dioxin	n	Adj. Mean ^{ab}	R ²	Adj. Slope (Std. Error) ^c	p-Value	Covariate Remarks
Low	171	94.5	0.046	0.013 (0.020)	0.509	AGE (p=0.036)
Medium	172	93.2				RACE (p=0.050)
High	168	99.4				PHYACT (p=0.003)

^a Transformed from natural logarithm scale.

^b 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.

^c Slope and standard error based on natural logarithm of IgM versus log₂ (initial dioxin).

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

Table O-3-17.
Analysis of Lupus Panel: Rheumatoid Factor
Occupation Removed from Final Model

a) MODEL 2: RANCH HANDS — INITIAL DIOXIN — ADJUSTED			
Analysis Results for Log₂ (Initial Dioxin)^a			
n	Adj. Relative Risk (95% C.I.)^b	p-Value	Covariate Remarks
511	0.83 (0.67,1.02)	0.075	AGE (p=0.235)

^a 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.

^b Relative risk for a twofold increase in initial dioxin.

b) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED				
Dioxin Category	n	Adj. Relative Risk (95% C.I.)^{ab}	p-Value	Covariate Remarks
Comparison	1,035			DXCAT*PHYACT (p=0.017) AGE (p=0.044) ALC (p=0.100)
Background RH	365	0.95 (0.68,1.31)**	0.742**	
Low RH	253	1.08 (0.75,1.55)**	0.670**	
High RH	251	0.62 (0.40,0.96)**	0.032**	
Low plus High RH	504	0.85 (0.63,1.15)**	0.285**	

^a Relative risk and confidence interval relative to Comparisons.

^b 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.

** Categorized dioxin-by-covariate interaction ($0.01 < p \leq 0.05$); adjusted relative risk, confidence interval, and p-value derived from a model fitted after deletion of this interaction; refer to Appendix Table O-4-10 for further analysis of this interaction.

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 O-3-17. (Continued)
Analysis of Lupus Panel: Rheumatoid Factor
Occupation Removed from Final Model

c) MODELS 4, 5, AND 6: RANCH HANDS — CURRENT DIOXIN — ADJUSTED				
Model^a	Analysis Results for Log₂ (Current Dioxin + 1)			
	n	Adj. Relative Risk (95% C.I.)^b	p-Value	Covariate Remarks
4	878	0.88 (0.77,1.01)	0.072	AGE (p=0.372) PHYACT (p=0.093)
5	878	0.89 (0.80,1.00)	0.042	AGE (p=0.360) PHYACT (p=0.093)
6 ^c	877	0.92 (0.82,1.04)	0.207	AGE (p=0.256) PHYACT (p=0.085)

^a Model 4: Log₂ (lipid-adjusted current dioxin + 1).
 Model 5: Log₂ (whole-weight current dioxin + 1).
 Model 6: Log₂ (whole-weight current dioxin + 1), adjusted for log₂ total lipids.

^b Relative risk for a twofold increase in current dioxin.

^c Adjusted for log₂ total lipids in addition to covariates specified under "Covariate Remarks" column.

Table O-3-18.
Analysis of Lupus Panel: B Cell Clones Detected by Serum Protein Electrophoresis
Occupation Removed from Final Model

a) MODEL 3: RANCH HANDS AND COMPARISONS BY DIOXIN CATEGORY — ADJUSTED				
Dioxin Category	n	Adj. Relative Risk (95% C.I.)^{ab}	p-Value	Covariate Remarks
Comparison	1,051			AGE (p=0.008)
Background RH	367	1.82 (0.87,3.82)	0.112	
Low RH	256	0.72 (0.24,2.13)	0.547	
High RH	255	1.33 (0.52,3.41)	0.547	
Low and High RH	511	0.99 (0.46,2.15)	0.979	

^a Relative risk and confidence interval relative to Comparisons.

^b 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.