Table 2-3

Sperm Count versus Current Dioxin and Time Since SEA Tour

Variable: Log(Sperm Count) (Million/ml)
Restrictions: None
Model 2: Log_2(Current Dioxin) and Time

Ranch Hands - Log_2(Current Dioxin), Time - Unadjusted

Exposure Restriction	Time Since SEA (years)	Mean/(n) Current Dioxin Low	Medium	High	Slope (Std. Error)	p-Value
a) D>10 ppt (n=266) (R^2=0.005)						0.407
	≤18.6	4.588 (34)	4.197 (58)	4.220 (31)	-0.093(0.103)	0.371
	>18.6	4.257 (32)	4.149 (65)	4.115 (46)	0.032(0.100)	0.753
b) D>5 ppt (n=371) (R^2=0.004)						0.662
	≤18.6	4.214 (54)	4.425 (85)	4.192 (49)	-0.031(0.065)	0.635
	>18.6	4.418 (33)	4.025 (89)	4.198 (61)	0.015(0.079)	0.852

Table 2-3 (Continued)

Ranch Hands - Log_2(Current Dioxin), Time - Adjusted

Exposure Restriction	Time Since SEA (years)	Adj. Mean/(n) Current Dioxin Low	Medium	High	Adj. Slope (Std. Error)	p-Value	Covariate Remarks
c) D>10 ppt (n=262)						0.379	
	≤18.6	4.606 (33)	4.197 (58)	4.202 (30)	-0.105(0.106)	0.326	None
	>18.6	4.257 (32)	4.161 (63)	4.115 (46)	0.031(0.101)	0.760	
d) D>5 ppt (n=366)						0.591	
	≤18.6	4.214 (54)	4.430 (84)	4.180 (48)	-0.036(0.066)	0.587	None
	>18.6	4.388 (32)	4.028 (88)	4.204 (60)	0.020(0.080)	0.798	

Sperm Count

Model 3: Ranch Hands and Comparisons - Categorized Current Dioxin

Without adjustment for covariates (Table 2-4 [a]), the overall association between sperm count and categorized current dioxin is not significant (p=0.778). Furthermore, the average counts among Ranch Hands in the High (p=0.876), Low (p=0.810) and Unknown (p=0.330) categories are not significantly different from the average count in Comparisons in the Background category.

After adjustment for covariates (Table 2-4 [b]), the overall association between sperm count and categorized current dioxin is not significant (p=0.807). Furthermore, the average counts among Ranch Hands in the High (p=0.819), Low (p=0.884) and Unknown (p=0.355) categories are not significantly different from the average count in Comparisons in the Background category.

Table 2-4

Sperm Count versus Categorized Current Dioxin

Variable: Log(Sperm Count) (Million/ml)
Restrictions: None
Model 3: Categorized Current Dioxin

a) Unadjusted

Exposure Category	n	Mean	Category Contrast	Difference of Means (95% C.I.)	p-Value
Background	449	4.171	All Exp Categ		0.778
Unknown	151	4.299	Unk vs Bkgd	0.128(-0.138,0.394)	0.330
Low	85	4.128	Low vs Bkgd	-0.043(-0.378,0.292)	0.810
High	110	4.195	High vs Bkgd	0.024(-0.077,0.325)	0.876
Total	795	(R^2=0.001)			

b) Adjusted

Exposure Category	n	Adj. Mean	Category Contrast	Diff. of Adj. Means (95% C.I.)	p-Value	Covariate Remarks
Background	441	4.157	All Exp Categ		0.807	None
Unknown	149	4.285	Unk vs Bkgd	0.128(-0.142,0.398)	0.355	
Low	84	4.133	Low vs Bkgd	-0.024(-0.363,0.315)	0.884	
High	108	4.194	High vs Bkgd	0.037(-0.268,0.342)	0.819	
Total	782	(R^2=0.001)				

Low Sperm Count (Counts Less than or Equal 60 million/ml)

Model 1: Ranch Hands - Log_2(Initial Dioxin)

Without adjustment for covariates (Table 2-5 [a] and [b]), there is no association between low sperm count and initial dioxin among Ranch Hands having more than 10 ppt (p=0.302) or more than 5 ppt (p=0.962) current dioxin.

After adjustment for covariates (Table 2-5 [c] and [d]), there is no association between low sperm count and initial dioxin among Ranch Hands having more than 10 ppt (p=0.230) or than 5 ppt (p=0.599) current dioxin.

Table 2-5

Low Sperm Count
Versus Initial Dioxin

Variable: Low Sperm Count (Discrete)
Restrictions: None
Model 1: Log_2(Initial Dioxin)

Ranch Hands - Log_2(Initial Dioxin) - Unadjusted

Exposure Restriction	Initial Dioxin	n	Abnormal Rate (n)	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=266)	Low	65	307.7(20)	1.11(0.91,1.37)	0.302
	Medium	125	288.0(36)		
	High	76	381.6(29)		
b) D>5 ppt (n=371)	Low	93	354.8(33)	1.00(0.86,1.16)	0.962
	Medium	168	327.4(55)		
	High	110	336.4(37)		

Ranch Hands - Log_2(Initial Dioxin) - Adjusted

Exposure Restriction	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=262)	1.13(0.92,1.40)	0.230	F-AGE*DIOXIN(P=0.058)
d) D>5 ppt (n=366)	0.96(0.82,1.12)	0.599	F-AGE(P=0.020)

Low Sperm Count

Model 2: Ranch Hands - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 2-6 [a]), there is no significant variation in the association between low sperm count and current dioxin with time since duty in SEA among Ranch Hands having more than 10 ppt current dioxin (p=0.888). Furthermore, there is no significant association between low sperm count and current dioxin in Ranch Hands with late (p=0.512) or early (p=0.782) tours.

Without adjustment for covariates (Table 2-6 [b]), there is no significant variation in the association between low sperm count and current dioxin with time since duty in SEA among Ranch Hands having more than 5 ppt current dioxin (p=0.382). Furthermore, there is no significant association between low sperm count and current dioxin in Ranch Hands who had late (p=0.478) or early (p=0.817) tours.

After adjustment for covariates (Table 2-6 [c]), there is no significant variation in the association between low sperm count and current dioxin with time since duty in SEA among Ranch Hands having more than 10 ppt current dioxin (p=0.722). Furthermore, there is no significant association between low sperm count and current dioxin in Ranch Hands who had late (p=0.347) or early (p=0.773) tours.

After adjustment for covariates (Table 2-6 [d]), there is no significant variation in the association between low sperm count and current dioxin with time since duty in SEA among Ranch Hands having more than 5 ppt current dioxin (p=0.501). Furthermore, there is no significant association between low sperm count and current dioxin among in Ranch Hands who had late tour (p=0.289) or early (p=0.911) tours.

Table 2-6

Low Sperm Count versus Current Dioxin and Time Since Duty in SEA

Variable: Low Sperm Count (Discrete)
Restriction: None
Model 2: Log_2(Current Dioxin) and Time

Ranch Hands - Log_2(Current Dioxin), Time - Unadjusted

Exposure Restriction	Time Since SEA (years)	Abnormal/Rate/(n) Current Dioxin Low	Medium	High	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=266)						0.888
	≤18.6	264.7 (9/34)	275.9 (16/58)	322.6 (10/31)	1.13(0.79,1.61)	0.512
	>18.6	343.8 (11/32)	292.3 (19/65)	434.8 (20/46)	1.09(0.59,2.03)	0.782
b) D>5 ppt (n=371)						0.382
	≤18.6	425.9 (23/54)	258.8 (22/85)	306.1 (15/49)	0.92(0.72,1.17)	0.478
	>18.6	272.7 (9/33)	359.6 (32/89)	393.4 (24/61)	1.05(0.67,1.65)	0.817

Ranch Hands - Log_2(Current Dioxin), Time - Adjusted

Exposure Restriction	Time Since SEA (years)	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=262)			0.722	None
	≤18.6	1.19(0.83,1.71)	0.347	
	>18.6	1.10(0.59,2.06)	0.773	
d) D>5 ppt (n=366)			0.501	F-AGE(p=0.009)
	≤18.6	0.87(0.68,1.12)	0.289	
	>18.6	0.97(0.62,1.54)	0.911	

Low Sperm Count

Model 3: Ranch Hands and Comparisons - Categorized Current Dioxin

Without adjustment for covariates (Table 2-7 [a]), the overall association between low sperm count and categorized current dioxin is not significant (p=0.298). However, the rate among Ranch Hands in the low current dioxin category (282.4 per 1000) is borderline significantly less than that of Comparisons in the Background category (383.1 per 1000); p=0.078. Corresponding contrasts of rates between Ranch Hands in the Unknown (p=0.319) and High (p=0.580) categories with Comparisons in the Background category are not significant.

After adjustment for covariates (Table 2-7 [b]), the overall association between low sperm count and categorized current dioxin is not significant (p=0.140). However, the rate among Ranch Hands in the low current dioxin category is significantly less than that of Comparisons in the Background category (OR=0.58, 95% CI 0.34-0.97, p=0.037). Corresponding contrasts of rates between Ranch Hands in the Unknown (p=0.334) and High (p=0.230) categories with Comparisons in the Background category are not significant.

Table 2-7

Low Sperm Count versus
Categorized Current Dioxin

Variable: Low Sperm Count (Discrete)
Restrictions: None
Model 3: Categorized Current Dioxin

Current Dioxin (Categorized Within Group)

a) Unadjusted

Exposure Category	n	Abnormal Rate (n)	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	449	383.1(172)	All Exp Categ		0.298
Unknown	151	337.7(51)	Unk vs Bkgd	0.82(0.56,1.21)	0.319
Low	85	282.4(24)	Low vs Bkgd	0.63(0.38,1.06)	0.078
High	110	354.5(39)	High vs Bkgd	0.88(0.57,1.37)	0.580
Total	795				

Table 2-7 (Continued)

b) Adjusted

Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	441	All Exp Categ		0.140	F-AGE(p=0.003)
Unknown	149	Unk vs Bkgd	0.82(0.56,1.22)	0.334	
Low	84	Low vs Bkgd	0.58(0.34,0.97)	0.037	
High	108	High vs Bkgd	0.76(0.49,1.19)	0.230	
Total	782				

Percent Abnormal Sperm

Model 1: Ranch Hands - Log_2(Initial Dioxin)

Without adjustment for covariates (Table 2-8 [a] and [b]), there is no association between percent abnormal sperm and initial dioxin among Ranch Hands having more than 10 ppt (p=0.934) or more than 5 ppt (p=0.587) current dioxin.

After adjustment for covariates (Table 2-8 [c] and [d]), there is no association between percent abnormal sperm and initial dioxin among Ranch Hands having more than 10 ppt (p=0.902) or more than 5 ppt (p=0.523) current dioxin.

Table 2-8

Percent Abnormal Sperm versus Initial Dioxin

Variable: Log(Percent Abnormal Sperm)
Restrictions: None
Model 1: Log_2 (Initial Dioxin)

Ranch Hands - Log_2(Initial Dioxin) - Unadjusted

Exposure Restriction	Initial Dioxin	n	Mean	Adj. Slope (Std. Error)	p-Value
a) D>10 ppt (n=257) (R^2=0.0000)	Low	64	2.206	-0.002(0.025)	0.934
	Medium	120	2.020		
	High	73	2.166		
b) D>5 ppt (n=361) (R^2=0.0008)	Low	93	2.165	-0.010(0.018)	0.587
	Medium	162	2.092		
	High	106	2.129		

Ranch Hands - Log_2(Initial Dioxin) - Adjusted

Exposure Restriction	Initial Dioxin	n	Adj. Mean	Adj. Slope (Std. Error)	p-Value	Covariate Remarks
c) D>10 ppt (n=253)	Low	63	2.209	0.004(0.004)	0.902	None
	Medium	118	2.015			
	High	72	2.169			
d) D>5 ppt (n=356)	Low	93	2.156	-0.012(0.018)	0.523	None
	Medium	159	2.099			
	High	104	2.127			

Percent Abnormal Sperm

Model 2: Ranch Hands - Log_2(Current Dioxin) and Time Since Duty in SEA

Without adjustment for covariates (Table 2-9 [a]), there is no significant variation in the association between percent abnormal sperm and current dioxin with time since duty in SEA among Ranch Hands having more than 10 ppt current dioxin (p=0.483). Furthermore, there is no significant association between percent abnormal sperm and current dioxin in Ranch Hands who had late (p=0.781) or early (p=0.438) tours.

Without adjustment for covariates (Table 2-9 [b]), there is no significant variation in the association between percent abnormal sperm and current dioxin with time since SEA tour of duty among Ranch Hands having more than 5 ppt current dioxin (p=0.761). Furthermore, there is no significant association between percent abnormal sperm and current dioxin in Ranch Hands who had late (p=0.681) or early (p=0.382) tours.

After adjustment for covariates (Table 2-9 [c]), there is no significant variation in the association between percent abnormal sperm and current dioxin with time since duty in SEA among Ranch Hands having more than 10 ppt current dioxin (p=0.459). Furthermore, there is no significant association between percent abnormal sperm and current dioxin in Ranch Hands who had late (p=0.774) or early (p=0.424) tours.

After adjustment for covariates (Table 2-9 [d]), there is no significant variation in the association between percent abnormal sperm and current dioxin with time since SEA tour of duty among Ranch Hands having more than 5 ppt current dioxin (p=0.638). Furthermore, there is no significant association between percent abnormal sperm and current dioxin in Ranch Hands who had late (p=0.699) or early (p=0.276) tours.

Table 2-9

Percent Abnormal Sperm versus Current Dioxin and Time Since Duty in SEA

Variable: Log(Percent Abnormal Sperm)
Restrictions: None
Model 2: Log_2(Current Dioxin) and Time

Ranch Hands - Log_2(Current Dioxin), Time - Unadjusted

Exposure Restriction	Time Since SEA (years)	Mean/(n) Current Dioxin Low	Medium	High	Adj. Slope (Std. Error)	p-Value
a) D>10 ppt (n=257) (R^2=0.0088)						0.483
	≤18.6	2.117 (34)	1.998 (57)	2.139 (30)	0.011(0.040)	0.781
	>18.6	2.298 (31)	2.054 (61)	2.161 (44)	-0.026(0.033)	0.438
b) D>5 ppt (n=361) (R^2=0.0076)						0.761
	≤18.6	2.137 (54)	2.049 (85)	2.095 (47)	-0.011(0.027)	0.681
	>18.6	2.154 (33)	2.173 (83)	2.129 (59)	-0.023(0.026)	0.382

Table 2-9 (Continued)

Ranch Hands - Log_2(Current Dioxin), Time - Adjusted

Exposure Restriction	Time Since SEA (years)	Adj. Means/(n) Current Dioxin Low	Medium	High	Adj. Slope (Std. Error)	p-Value	Covariate Remarks
c) D>10 ppt (n=253)						0.459	
	≤18.6	2.121 (33)	1.998 (57)	2.145 (29)	0.012(0.042)	0.774	None
	>18.6	2.298 (31)	2.045 (59)	2.161 (44)	-0.027(0.033)	0.424	
d) D>5 ppt (n=356)						0.638	
	≤18.6	2.137 (54)	2.050 (84)	2.098 (46)	-0.011(0.028)	0.699	None
	>18.6	2.186 (32)	2.174 (82)	2.122 (58)	-0.028(0.026)	0.276	

Percent Abnormal Sperm

Model 3: Ranch Hands and Comparisons - Categorized Current Dioxin

Without adjustment for covariates (Table 2-10 [a]), the overall association between percent abnormal sperm and categorized current dioxin is not significant (p=0.111). Furthermore, the average percent abnormal sperm among Ranch Hands in the High (p=0.869) and Unknown (p=0.176) categories are not significantly different from that of Comparisons in the Background category, while the average percent abnormal sperm among Ranch Hands in the Low category is borderline significantly less than that of Comparisons in the Background category (p=0.088).

After adjustment for covariates (Table 2-10 [b]), the overall association between percent abnormal sperm and categorized current dioxin is borderline significant (p=0.096). However, the average percent abnormal sperm among Ranch Hands in the High (p=0.842) and Unknown (p=0.128) categories are not significantly different from that of Comparisons in the Background category, while the average percent abnormal sperm among Ranch Hands in the Low category is borderline significantly less than that of Comparisons in the Background category ((p=0.097).

Table 2-10

Percent Abnormal Sperm versus Categorized Current Dioxin

Variable: Log(Percent Abnormal Sperm)
Restrictions: None
Model 3: Categorized Current Dioxin

a) **Unadjusted**

Exposure Category	n	Mean	Category Contrast	Difference of Means (95% C.I.)	p-Value
Background	437	2.105	All Exp Categ		0.111
Unknown	150	2.171	Unk vs Bkgd	0.066(-0.030,0.162)	0.176
Low	81	1.997	Low vs Bkgd	-0.108(-0.230,0.014)	0.088
High	106	2.114	High vs Bkgd	0.009(-0.100,0.118)	0.869
Total	774	(R^2=0.0078)			

b) **Adjusted**

Exposure Category	n	Mean	Category Contrast	Diff. of Adj. Means (95% C.I.)	p-Value	Covariate Remarks
Background	429	2.100	All Exp Categ		0.096	None
Unknown	148	2.175	Unk vs Bkgd	0.075(-0.021,0.171)	0.128	
Low	80	1.996	Low vs Bkgd	-0.104(-0.227,0.019)	0.097	
High	104	2.111	High vs Bkgd	0.011(-0.099,0.121)	0.842	
Total	761	(R^2=0.0083)				

High Percent Abnormal

Only two fathers (Comparisons) had percent abnormal sperm greater than 30, hence this categorized variable was not analyzed.

2.3 Conclusion

The statistical significance of the association between the father's dioxin level and sperm count, the rate of abnormally low sperm count, and the percentage of abnormal sperm was assessed based on semen specimens collected during the initial examination in 1982.

The association between semen characteristics and dioxin were assessed with Models 1, 2 and 3. The results are summarized in Table 2-11 through Table 2-13.

Throughout this section, nonsignificant results are indicated by NS, borderline significant results are indicated by NS* and the presence of interactions with the p-value greater than or equal to 0.01 and less than 0.05 are indicated with a preceding double asterisk (**). Four asterisks (****) represent the presence of an interaction between a covariate and dioxin with a p-value less than 0.01. The p-value is replace by a double hyphen (--) when the analysis was not carried out due to sparse data.

Table 2-11

P-Value Summary of Sperm Count, Low Sperm Count (≤60 Million/ml) and Percentage Abnormal Forms versus Initial Dioxin Level (Model 1)

Variable	Unadjusted D>10 ppt	Unadjusted D>5 ppt	Adjusted D>10 ppt	Adjusted D>5 ppt
Sperm Count (continuous)	NS	NS	NS	NS
Low Sperm Count	NS	NS	NS	NS
Percentage Abnormal Sperm	NS	NS	NS	NS

Table 2-12

P-Value Summary of Sperm Count, Low Sperm Count (≤60 Million/ml) and Percentage Abnormal Forms versus Current Dioxin and Time Since SEA Tour (Model 2)

a) Unadjusted

Variable	D>10 ppt Dioxin by Time	D>10 ppt Time Since SEA ≤18.6	D>10 ppt Time Since SEA >18.6	D>5 ppt Dioxin by Time	D>5 ppt Time Since SEA ≤18.6	D>5 ppt Time Since SEA >18.6
Sperm Count (continuous)	NS	NS	NS	NS	NS	NS
Low Sperm Count	NS	NS	NS	NS	NS	NS
Percentage Abnormal Sperm	NS	NS	NS	NS	NS	NS

Table 2-12 (Continued)

b) Adjusted

Variable	D>10 ppt Dioxin by Time	D>10 ppt Time Since SEA ≤18.6	D>10 ppt Time Since SEA >18.6	D>5 ppt Dioxin by Time	D>5 ppt Time Since SEA ≤18.6	D>5 ppt Time Since SEA >18.6
Sperm Count (continuous)	NS	NS	NS	NS	NS	NS
Low Sperm Count	NS	NS	NS	NS	NS	NS
Percentage Abnormal Sperm	NS	NS	NS	NS	NS	NS

Table 2-13

P-Value Summary of Categorized Current Dioxin Analyses of Sperm Count, Low Sperm Count (≤60 Million/ml) and Percentage Abnormal Forms (Model 3)

a) Unadjusted

Variable	All	Unknown versus Background	Low versus Background	High versus Background
Sperm Count (continuous)	NS	NS	NS	NS
Low Sperm Count	NS	NS	NS*	NS
Percentage Abnormal Sperm	NS	NS	NS*	NS

b) Adjusted

Variable	All	Unknown versus Background	Low versus Background	High versus Background
Sperm Count (continuous)	NS	NS	NS	NS
Low Sperm Count	NS	NS	0.037	NS
Percentage Abnormal Sperm	NS*	NS	NS*	NS

The one significant result and the few borderline findings in these analyses indicate lower risks in exposed individuals. We conclude there is no association in these data between dioxin and sperm count, the low sperm count or percentage of abnormal sperm.

3. CONCEPTIONS

3.1 Introduction

Assessments of the association between miscarriage and dioxin level were carried out using Models 1, 2 and 3 in pre-post SEA and post-SEA analyses (as described in Section 1.3). A composite variable called total adverse outcome was defined as the occurrence of a miscarriage, tubal pregnancy, other (non-induced) abortive pregnancy or stillbirth. The association between total adverse outcome and the father's dioxin level was carried out in parallel with the assessments of miscarriage. The association between total conceptions per father and dioxin was assessed using Models 1, 2 and 3.

In this chapter conceptions were categorized as full siblings if all conceptions resulted from a participant impregnation of one woman, regardless of the number of relationships the participant had. Analyses of each of these three variables are carried out without and then with restriction to full siblings.

Summary counts and rates of conception outcome by time of conception and the father's exposure restriction (D>10 ppt, D>5 ppt) for Models 1 and 2 are shown in Table 3-1. Rates were computed as the number of occurrences per 1000 conceptions.

In Table 3-1, there is one more live birth for each time of conception for Ranch Hands with D>10 ppt in Model 2, otherwise the sample sizes for Model 2 are the same as for Model 1.

Table 3-1

Counts and Rates of Births and Abortive Pregnancies in Conceptions Included in Models 1 and 2 Classified by Time of Conception Relative to the Father's Duty in SEA

a) Ranch Hands with D>10 ppt

	Time of Conception	
	Pre-SEA Count (Rate)	Post-SEA Count (Rate)
Abortive Pregnancies		
Miscarriage	120 (143.5)	100 (157.0)
Induced abortion	1 (1.2)	18 (28.3)
Tubal pregnancy	2 (2.4)	2 (3.1)
Other	0 (0.0)	2 (3.1)
Total Births		
Live Birth	700 (837.3)	508 (797.5)
Stillbirth	13 (15.6)	7 (11.0)
Total Pregnancies	836	637

b) Ranch Hands with D>5 ppt

	Time of Conception	
	Pre-SEA Count (Rate)	Post-SEA Count (Rate)
Abortive Pregnancies		
Miscarriage	191 (150.2)	133 (152.7)
Induced abortion	3 (2.4)	30 (34.4)
Tubal pregnancy	3 (2.4)	3 (3.4)
Other	1 (0.8)	2 (2.3)
Total Births		
Live Birth	1058 (831.8)	690 (792.2)
Stillbirth	16 (12.6)	13 (14.9)
Total Pregnancies	1272	871

Summary counts and rates of reproductive outcome by time of conception relative to SEA duty among conceptions included in Model 3 analyses are shown in Table 3-2.

Table 3-2

Counts and Rates of Births and Abortive Pregnancies of Conceptions Included in Model 3 Analyses Classified by Time of Conception Relative to Duty in SEA

	Time of Conception	
	Pre-SEA Count (Rate)	Post-SEA Count (Rate)
a) **Abortive Pregnancies**		
Miscarriage	395 (133.9)	305 (145.5)
Induced Abortion	9 (3.0)	91 (43.4)
Tubal Pregnancy	9 (3.0)	8 (3.8)
Other	3 (1.0)	4 (1.9)
b) **Total Births**		
Live Birth	2499 (846.8)	1664 (793.9)
Stillbirth	36 (12.2)	24 (11.5)
Total Conceptions	2951	2096

3.2 Pre-Post SEA Exposure Analyses

Miscarriage (All Conceptions)

Model 1: Conceptions of Ranch Hands - Log_2(Initial Dioxin)

Without adjustment for covariates (Table 3-3), there is no significant variation in the association between miscarriage and initial dioxin with time of conception among conceptions fathered by Ranch Hands having more than 10 ppt ($p=0.795$) or more than 5 ppt current dioxin ($p=0.320$).

Table 3-3

Pre-Post SEA Counts and Rates of Miscarriage

Variable: Miscarriage (MC)
Restrictions: All Conceptions of Ranch Hands
Model 1: Log_2(Initial Dioxin)

Ranch Hands - Log_2(Initial Dioxin) - Unadjusted

Exposure Restriction	Initial Dioxin	Time of Conception Relative to the Father's Duty in SEA: Pre-SEA n	Pre-SEA MC	Pre-SEA Rate	Post-SEA n	Post-SEA MC	Post-SEA Rate	p-Value
a) D>10 ppt (n=1473)	Low	293	40	136.5	136	21	154.4	0.795
	Medium	406	61	150.2	310	49	158.1	
	High	137	19	138.7	191	30	157.1	
b) D>5 ppt (n=2143)	Low	352	60	170.5	199	27	135.7	0.320
	Medium	726	100	137.7	392	61	155.6	
	High	194	31	159.8	280	45	160.7	

Miscarriage (All Conceptions)

Model 2: Conceptions of Ranch Hands - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 3-4 [a]), there is significant variation in the association between miscarriage and current dioxin level with time since duty in SEA and time of conception among conceptions fathered by Ranch Hands having more than 10 ppt current dioxin (p=0.014). This significance is due to the lower miscarriage rate (48.8 per 1000) among pre-SEA conceptions of Ranch Hands in the High dioxin category.

Without adjustment for covariates (Table 3-4 [b]), there is significant variation in the association between miscarriage and current dioxin level with time since duty in SEA and time of conception among conceptions fathered by Ranch Hands having more than 5 ppt current dioxin (p=0.024). This significance is due to a reversal of the association between miscarriages and dioxin in conceptions of Ranch Hands with late tours; pre-SEA miscarriages decrease with dioxin and post-SEA miscarriages increase with dioxin in this stratum.

Table 3-4

Pre-Post SEA Counts and Rates of Miscarriage

Variable: Miscarriage (MC)
Restrictions: All Conceptions of Ranch Hands
Model 2: Log_2(Current Dioxin), Time

Ranch Hands - Log_2(Current Dioxin), Time - Unadjusted

Exposure Restriction	Time of Conception	Time Since SEA (years)	Miscarriage Rate (No./n) Current Dioxin Low	Medium	High	p-Value
a) D>10 ppt (n=1475)	Pre-SEA	≤18.6	142.0 (23/162)	146.8 (32/218)	48.8 (2/41)	0.014
		>18.6	123.9 (14/113)	159.4 (33/207)	166.7 (16/96)	
	Post-SEA	≤18.6	92.1 (7/76)	136.6 (22/161)	168.5 (15/89)	
		>18.6	237.3 (14/59)	198.6 (29/146)	121.5 (13/107)	
b) D>5 ppt (n=2143)	Pre-SEA	≤18.6	170.1 (33/194)	152.4 (57/374)	126.6 (10/79)	0.024
		>18.6	120.7 (21/174)	150.3 (49/326)	168.0 (21/125)	
	Post-SEA	≤18.6	127.1 (15/118)	132.7 (28/211)	154.4 (21/136)	
		>18.6	103.9 (8/77)	202.2 (37/183)	164.4 (24/146)	

Miscarriage (All Conceptions)

Model 3: Conceptions of Ranch Hands and Comparisons - Categorized Current Dioxin

Without adjustment for covariates (Table 3-5), there is no significant variation in the association between miscarriage and categorized current dioxin with time of conception (p=0.986). Furthermore, the association between miscarriage and time of conception among conceptions fathered by Ranch Hands in High (p=0.825), Low (p=0.744) and Unknown (p=0.864) categories do not differ significantly from the corresponding association among conceptions fathered by Comparisons in the Background category.

Table 3-5

Pre-Post SEA Counts and Rates of Miscarriage

Variable: Miscarriage (MC)
Restriction: All Conceptions of Ranch Hands and Comparisons
Model 3: Categorized Current Dioxin

	Time of Conception Relative to the Father's Duty in SEA								
Exposure	Pre-SEA			Post-SEA			Odds	Category	
Category	n	MC	Rate	n	MC	Rate	Ratio	Contrast	p-Value
Background	1712	215	125.6	1235	172	139.3	1.13	All Exp Categ	0.986
Unknown	691	100	144.7	367	57	155.3	1.09	Unk vs Bkgd	0.864
Low	344	49	142.4	212	31	146.2	1.03	Low vs Bkgd	0.744
High	204	31	152.0	282	45	159.6	1.06	High vs Bkgd	0.825
Total	2951			2096					

Miscarriage (Full Siblings)

Model 1: Conceptions of Ranch Hands - Log_2(Initial Dioxin)

Without adjustment for covariates (Table 3-6), there is no significant variation in the association between miscarriage and initial dioxin with time of conception among full siblings fathered by Ranch Hands having more than 10 ppt (p=0.330) or more than 5 ppt (p=0.228) current dioxin.

Table 3-6

Pre-Post SEA Counts and Rates of Miscarriage

Variable: Miscarriage (MC)
Restrictions: Full Siblings of Ranch Hands
Model 1: Log_2(Initial Dioxin)

Ranch Hands - Log_2(Initial Dioxin) - Unadjusted

Exposure Restriction	Initial Dioxin	Time of Conception Relative to the Father's Duty in SEA: Pre-SEA n	Pre-SEA MC	Pre-SEA Rate	Post-SEA n	Post-SEA MC	Post-SEA Rate	p-Value
a) D>10 ppt (n=1222)	Low	273	39	142.9	98	15	153.1	0.330
	Medium	325	48	147.7	246	32	130.1	
	High	121	14	115.7	159	25	157.2	
b) D>5 ppt (n=1784)	Low	308	53	172.1	149	23	154.4	0.228
	Medium	630	86	136.5	300	42	140.0	
	High	164	25	152.4	233	35	150.2	

Miscarriage (Full Siblings)

Model 2: Conceptions of Ranch Hands - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 3-7 [a]), there is borderline significant variation in the association between miscarriage and current dioxin level with time since duty in SEA and time of conception among full siblings fathered by Ranch Hands having more than 10 ppt current dioxin (p=0.076). This borderline significance is due to the reduced rate of miscarriages among pre-SEA conceptions fathered by Ranch Hands in the High current dioxin category, late tour, and the increased rate among the post-SEA conceptions in the Low current dioxin category, early tour.

Without adjustment for covariates (Table 3-7 [b]), there is borderline significant variation in the association between miscarriage and current dioxin level with time since duty in SEA and time of conception among full siblings fathered by Ranch Hands having more than 5 ppt current dioxin (p=0.071). This borderline significance is due to the decreasing pre-SEA miscarriage rates with dioxin among conceptions fathered by Ranch Hands with late tours and increasing rates among conceptions fathered by Ranch Hands with early tours.

Table 3-7

Pre-Post SEA Counts and Rates of Miscarriage

Variable: Miscarriage (MC)
Restrictions: Full Siblings of Ranch Hands
Model 2: Log_2(Current Dioxin), Time

Ranch Hands - Log_2(Current Dioxin), Time - Unadjusted

Exposure Restriction	Time of Conception	Time Since SEA (years)	Miscarriage Rate (No./n) Current Dioxin Low	Medium	High	p-Value
a) D>10 ppt (n=1224)	Pre-SEA	≤18.6	154.4 (23/149)	152.2 (28/184)	51.3 (2/39)	0.076
		>18.6	128.7 (13/101)	144.6 (24/166)	135.8 (11/81)	
	Post-SEA	≤18.6	89.3 (5/56)	126.9 (17/134)	146.7 (11/75)	
		>18.6	238.1 (10/42)	169.6 (19/112)	117.6 (10/85)	
b) D>5 ppt (n=1784)	Pre-SEA	≤18.6	196.2 (31/158)	159.6 (53/332)	138.9 (10/72)	0.071
		>18.6	95.5 (15/157)	139.8 (39/279)	153.8 (16/104)	
	Post-SEA	≤18.6	148.1 (12/81)	125.0 (21/168)	144.1 (17/118)	
		>18.6	109.4 (7/64)	182.5 (25/137)	157.9 (18/114)	

Miscarriage (Full Siblings)

Model 3: Conceptions of Ranch Hands and Comparisons - Categorized Current Dioxin

Without adjustment for covariates (Table 3-8), there is no significant variation in the association between miscarriage and categorized current dioxin with time of conception among full siblings (p=0.772). Furthermore, the association between miscarriage and time of conception among conceptions fathered by Ranch Hands in the High (p=0.659), Low (p=0.309) and Unknown (p=0.777) categories do not differ significantly from the corresponding association among conceptions fathered by Comparisons in the Background category.

Table 3-8

Pre-Post SEA Counts and Rates of Miscarriage

Variable: Miscarriage (MC)
Restrictions: Full Siblings of Ranch Hands and Comparisons
Model 3: Categorized Current Dioxin

Exposure Category	Time of Conception Relative to the Father's Duty in SEA: Pre-SEA n	Pre-SEA MC	Pre-SEA Rate	Post-SEA n	Post-SEA MC	Post-SEA Rate	Odds Ratio	Category Contrast	p-Value
Background	1450	180	124.1	982	140	142.6	1.17	All Exp Categ	0.772
Unknown	604	92	152.3	279	46	164.9	1.10	Unk vs Bkgd	0.777
Low	282	37	131.2	168	19	113.1	0.84	Low vs Bkgd	0.309
High	176	26	147.7	232	35	150.9	1.03	High vs Bkgd	0.659
Total	2512			1661					

Total Adverse Outcome (All Conceptions)

Model 1: Conceptions of Ranch Hands - Log_2(Initial Dioxin)

Without adjustment for covariates (Table 3-9 [a]), there is no significant variation in the association between total adverse outcome and initial dioxin with time of conception among conceptions fathered by Ranch Hands with more than 10 ppt current dioxin (p=0.544).

Without adjustment for covariates (Table 3-9 [b]), there is no significant variation in the association between adverse conception outcome and initial dioxin with time of conception among conceptions fathered by Ranch Hands with more than 5 ppt current dioxin (p=0.950).

Table 3-9

Pre-Post SEA Counts and Rates of Total Adverse Outcome

Variable: Total Adverse Outcome (Advs)
Restrictions: All Conceptions of Ranch Hands
Model 1: Log_2(Initial Dioxin)

Exposure Restriction	Initial Dioxin	Time of Conception Relative to the Father's Duty in SEA: Pre-SEA n	Pre-SEA Advs	Pre-SEA Rate	Post-SEA n	Post-SEA Advs	Post-SEA Rate	p-Value
a) D>10 ppt (n=1454)	Low	293	44	150.2	129	23	178.3	0.544
	Medium	405	67	165.4	303	58	191.4	
	High	137	24	175.2	187	30	160.4	
b) D>5 ppt (n=2110)	Low	351	65	185.2	188	33	175.5	0.950
	Medium	724	108	149.2	379	71	187.3	
	High	194	38	195.9	274	47	171.5	

Total Adverse Outcome (All Conceptions)

Model 2: Conceptions of Ranch Hands - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 3-10 [a]), there is significant variation in the association between total adverse outcome and current dioxin with time since duty in SEA and time of conception among conceptions fathered by Ranch Hands having more than 10 ppt current dioxin (p=0.025). This significance is due to reversals in the pattern of adverse outcome rates with time of conception. The rate decreases with dioxin in pre-SEA conceptions of Ranch Hands with late tours and in post-SEA conceptions of Ranch Hands with early tours. The rate increases with dioxin in pre-SEA conceptions of Ranch Hands with early tours and post-SEA conceptions of Ranch Hands with late tours.

Without adjustment for covariates (Table 3-10 [b]), there is significant variation in the association between total adverse outcome and current dioxin with time of conception and time since duty in SEA (p=0.045). This significance is due to a high post-SEA rate (240.2 per 1000) in conceptions fathered by Ranch Hands with early tours having intermediate dioxin levels.

Table 3-10

Pre-Post SEA Counts and Rates of Total Adverse Outcome

Variable: Total Adverse Outcome
Restrictions: All Conceptions of Ranch Hands
Model 2: Log_2(Current Dioxin), Time

Exposure Restriction	Time of Conception	Time Since SEA (years)	Abnormal Rate (No./n) Current Dioxin Low	Medium	High	p-value
a) D>10 ppt (n=1456)	Pre-SEA	≤18.6	154.3 (25/162)	160.6 (35/218)	97.6 (4/41)	0.025
		>18.6	159.3 (18/113)	169.9 (35/206)	187.5 (18/96)	
	Post-SEA	≤18.6	126.8 (9/71)	151.9 (24/158)	172.4 (15/87)	
		>18.6	298.2 (17/57)	234.0 (33/141)	122.6 (13/106)	
b) D>5 ppt (n=2110)	Pre-SEA	≤18.6	190.7 (37/194)	163.1 (61/374)	164.6 (13/79)	0.045
		>18.6	127.9 (22/172)	169.2 (55/325)	184.0 (23/125)	
	Post-SEA	≤18.6	181.8 (20/110)	147.1 (30/204)	172.9 (23/133)	
		>18.6	137.0 (10/73)	240.2 (43/179)	176.1 (25/142)	

Total Adverse Outcome (All Conceptions)

Model 3: Conceptions of Ranch Hands and Comparisons - Categorized Current Dioxin

Without adjustment for covariates (Table 3-11), there is no significant overall variation in the association between total adverse outcome and categorized current dioxin with time of conception (p=0.859). Furthermore, the association between total adverse outcome and time of conception among conceptions fathered by Ranch Hands in the High (p=0.523), Low (p=0.735) and Unknown (p=0.727) categories are not significantly different from the corresponding association among conceptions fathered by Comparisons in the Background category.

Table 3-11

Pre-Post SEA Counts and Rates of Total Adverse Outcome

Variable: Total Adverse Outcome
Restrictions: All Conceptions of Ranch Hands and Comparisons
Model 3: Categorized Current Dioxin

	Time of Conception Relative to the Father's Duty in SEA								
Exposure	Pre-SEA			Post-SEA			Odds	Category	
Category	n	Abn	Rate	n	Abn	Rate	Ratio	Contrast	p-Value
Background	1706	247	144.8	1175	194	165.1	1.17	All Exp Categ	0.859
Unknown	689	107	155.3	347	65	187.3	1.25	Unk vs Bkgd	0.727
Low	343	53	154.5	208	34	163.5	1.07	Low vs Bkgd	0.735
High	204	36	176.5	275	48	174.5	0.99	High vs Bkgd	0.523
Total	2942			2005					

Total Adverse Outcome (Full Siblings)

Model 1: Conceptions of Ranch Hands - Log_2(Initial Dioxin)

Without adjustment for covariates (Table 3-12 [a]), there is no significant variation in the association between total adverse outcomes and initial dioxin with time of conception among full siblings fathered by Ranch Hands with more than 10 ppt current dioxin (p=0.874).

Without adjustment for covariates (Table 3-12 [b]), there is no significant variation in the association between total adverse outcomes and initial dioxin with time of conception among full siblings fathered by Ranch Hands with more than 5 ppt current dioxin (p=0.727).

Table 3-12

Pre-Post SEA Counts and Rates of Total Adverse Outcome

Variable: Total Adverse Outcome
Restrictions: Full Siblings of Ranch Hands
Model 1: Log_2(Initial Dioxin)

Exposure Restriction	Initial Dioxin	Time of Conception Relative to the Father's Duty in SEA: Pre-SEA n	Pre-SEA Advs	Pre-SEA Rate	Post-SEA n	Post-SEA Advs	Post-SEA Rate	p-Value
a) D>10 ppt (n=1211)	Low	273	42	153.8	94	16	170.2	0.874
	Medium	325	52	160.0	242	40	165.3	
	High	121	18	148.8	156	25	160.3	
b) D>5 ppt (n=1763)	Low	307	58	188.9	141	27	191.5	0.727
	Medium	630	92	146.0	292	51	174.7	
	High	164	30	182.9	229	36	157.2	

Total Adverse Outcome (Full Siblings)

Model 2: Conceptions of Ranch Hands - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 3-13 [a]), there is borderline significant variation in the association between total adverse outcome and current dioxin with time since duty in SEA and time of conception among full siblings fathered by Ranch Hands having more than 10 ppt current dioxin (p=0.056). This significance is due a reversal in the pattern of adverse outcome rates with time of conception in conceptions of Ranch Hands with late tours. Among pre-SEA conceptions, the rate decreases with increasing current dioxin. Among post-SEA conceptions, the rate increases with increasing current dioxin.

Without adjustment for covariates (Table 3-13 [b]), there is borderline significant variation in the association between total adverse outcomes and current dioxin with time since duty in SEA and time of conception among full siblings fathered by Ranch Hands having more than 10 ppt current dioxin (p=0.076). This significance is due to a reversal in the pattern of adverse outcome rates with time of conception. Among pre-SEA conceptions of Ranch Hands with early tours, the rate increases with increasing current dioxin and among pre-SEA conceptions of Ranch Hands with late tours the rate decreases with current dioxin. Among post-SEA conceptions no such trends are apparent.

Table 3-13

Pre-Post SEA Counts and Rates of Total Adverse Outcome

Variable: Total Adverse Outcome
Restrictions: Full Siblings of Ranch Hands
Model 2: Log_2(Current Dioxin), Time

Exposure Restriction	Time of Conception	Time Since SEA (years)	Abnormal Rate (No./n) Current Dioxin Low	Medium	High	p-value
a) D>10 ppt (n=1213)	Pre-SEA	≤18.6	167.8 (25/149)	157.6 (29/184)	102.6 (4/39)	0.056
		>18.6	158.4 (16/101)	156.6 (26/166)	148.1 (12/81)	
	Post-SEA	≤18.6	113.2 (6/53)	143.9 (19/132)	150.7 (11/73)	
		>18.6	317.1 (13/41)	200.0 (22/110)	119.0 (10/84)	
b) D>5 ppt (n=1763)	Pre-SEA	≤18.6	221.5 (35/158)	168.7 (56/332)	166.7 (12/72)	0.076
		>18.6	102.6 (16/156)	157.7 (44/279)	163.5 (17/104)	
	Post-SEA	≤18.6	213.3 (16/75)	134.1 (22/164)	165.2 (19/115)	
		>18.6	131.1 (8/61)	229.6 (31/135)	160.7 (18/112)	

Total Adverse Outcome (Full Siblings)

Model 3: Conceptions of Ranch Hands and Comparisons - Categorized Current Dioxin

Without adjustment for covariates (Table 3-14), there is no overall variation in the association between total adverse outcome and categorized current dioxin with time of conception (p=0.723) in full siblings. Furthermore, the association between total adverse outcome and time of conception in

conceptions fathered by Ranch Hands in the High (p=0.460), Low (p=0.357) and Unknown (p=0.979) categories are not significantly different from the corresponding association among conceptions fathered by Comparisons in the Background category.

Table 3-14

Pre-Post SEA Counts and Rates of Total Adverse Outcome

Variable: Total Adverse Outcome
Restrictions: Full Siblings of Ranch Hands and Comparisons
Model 3: Categorized Current Dioxin

	Time of Conception Relative to the Father's Duty in SEA								
Exposure Category	Pre-SEA n	Pre-SEA Abn	Pre-SEA Rate	Post-SEA n	Post-SEA Abn	Post-SEA Rate	Odds Ratio	Category Contrast	p-Value
Background	1445	207	143.3	946	161	170.2	1.23	All Exp Categ	0.723
Unknown	603	98	162.5	264	51	193.2	1.23	Unk vs Bkgd	0.979
Low	282	40	141.8	166	22	132.5	0.92	Low vs Bkgd	0.357
High	176	29	164.8	227	37	163.0	0.99	High vs Bkgd	0.460
Total	2506			1603					

The total conceptions data consisted of at least one conception per father because fathers with no conceptions were not considered. Fathers with conceptions in both pre-SEA and post-SEA were considered twice. The data for total conceptions is very non-normally distributed. Hence, total conception means are reported for descriptive purposes but probability levels are reported from the analyses of ranked values of total conceptions.

Total Conceptions (All Conceptions)

Model 1: Conceptions of Ranch Hands - Log_2(Initial Dioxin)

Without adjustment for covariates (Table 3-15 [a]), there is no significant variation in the association between total conceptions and initial dioxin with time of conception among conceptions fathered by Ranch Hands having more than 10 ppt current dioxin (p=0.143).

Without adjustment for covariates (Table 3-15 [b]), there is no significant variation in the association between total conceptions and initial dioxin with time of conception among conceptions fathered by Ranch Hands having more than 5 ppt current dioxin (p=0.177).

Table 3-15

Pre-Post SEA Total Conceptions

Variable: Total Conceptions
Restrictions: All Conceptions of Ranch Hands
Model 1: Log_2(Initial Dioxin)

Exposure Restriction	Initial Dioxin	Time of Conception Relative to the Father's Duty in SEA: Pre-SEA n	Pre-SEA Mean	Post-SEA n	Post-SEA Mean	p-Value
a) D>10 ppt	Low	96	3.05	56	2.43	0.143
(n=560)	Medium	139	2.92	139	2.23	
(R^2=0.04)	High	51	2.69	79	2.42	
b) D>5 ppt	Low	128	2.75	94	2.12	0.177
(n=827)	Medium	238	3.05	177	2.21	
(R^2=0.04)	High	73	2.66	117	2.39	

Total Conceptions (All Conceptions)

Model 2: Conceptions of Ranch Hands - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 3-16 [a] and [b]), there is no significant variation in the association between total conceptions and current dioxin with time since duty in SEA and time of conception among conceptions fathered by Ranch Hands having more than 10 ppt (p=0.147) while there is borderline significance in conceptions of fathers having more than 5 ppt dioxin (p=0.083). The borderline significance is due to the increasing trends in total post-SEA conceptions with increasing levels of dioxin.

Table 3-16

Pre-Post SEA Total Conceptions

Variable: Total Conceptions
Restrictions: All Conceptions of Ranch Hands
Model 2: Log_2(Current Dioxin), Time

Exposure Restriction	Time of Conception	Time Since SEA (years)	Mean total Conceptions (n) Current Dioxin Low	Medium	High	p-value
a) D>10 ppt (n=562) (R^2=0.04)	Pre-SEA	≤18.6	2.95 (55)	3.16 (69)	2.16 (19)	0.147
		>18.6	2.97 (38)	2.80 (74)	3.00 (32)	
	Post-SEA	≤18.6	2.24 (34)	2.30 (70)	2.47 (36)	
		>18.6	2.36 (25)	2.28 (64)	2.33 (46)	
b) D>5 ppt (n=827) (R^2=0.04)	Pre-SEA	≤18.6	2.73 (71)	3.07 (122)	2.47 (32)	0.083
		>18.6	2.90 (60)	2.94 (111)	2.91 (43)	
	Post-SEA	≤18.6	2.11 (56)	2.18 (97)	2.57 (53)	
		>18.6	2.03 (38)	2.20 (83)	2.39 (61)	

Total Conceptions (All Conceptions)

Model 3: Conceptions of Ranch Hands and Comparisons - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 3-17), there is no significant variation in the overall association between total conceptions and categorized current dioxin with time of conception (p=0.168). However, the change in the average number of conceptions from pre-SEA to post-SEA among those fathered by Ranch Hands in the High category (2.72-2.47=0.25) is significantly less than

that (2.91-2.17=0.74) of Comparisons in the Background category (p=0.026). Corresponding contrasts of pre-SEA to post-SEA changes in conceptions of Ranch Hands in the Low (p=0.902) and Unknown (p=0.986) categories with changes among Comparisons in the Background category are not significant.

Table 3-17

Pre-Post SEA Total Conceptions

Variable: Total Conceptions
Restrictions: All Conceptions of Ranch Hands and Comparisons
Model 3: Categorized Current Dioxin

	Time of Conception Relative to the Father's Duty in SEA					
Exposure Category	Pre-SEA n	Pre-SEA Mean	Post-SEA n	Post-SEA Mean	Exposure Contrast	p-Value
Background	588	2.91	570	2.17	All Exp Categ	0.168
Unknown	244	2.83	178	2.06	Unk vs Bkgd	0.986
Low	113	3.04	98	2.16	Low vs Bkgd	0.902
High	75	2.72	114	2.47	High vs Bkgd	0.026
Total	1020		960		(R^2=0.05)	

Total Conceptions (Full Siblings)

Model 1: Conceptions of Ranch Hands - Log_2(Initial Dioxin)

Without adjustment for covariates (Table 3-18 [a]), there is significant variation in the association between total conceptions and initial dioxin with time of conception among full siblings fathered by Ranch Hands having more than 10 ppt current dioxin (p=0.026). This significance is due to a decrease in pre-SEA total conceptions with initial dioxin and no trend in post-SEA total conceptions.

Without adjustment for covariates (Table 3-18 [b]), there is significant variation in the association between total conceptions and initial dioxin with time of conception among full siblings fathered by Ranch Hands having more than 5 ppt current dioxin (p=0.033). This significance is due to an increase in post-SEA total conceptions with initial dioxin and no trend in pre-SEA total conceptions.

Table 3-18

Pre-Post SEA Total Conceptions

Variable: Total Conceptions
Restrictions: Full Siblings of Ranch Hands
Model 1: Log_2(Initial Dioxin)

Exposure Restriction	Initial Dioxin	Time of Conception Relative to the Father's Duty in SEA: Pre-SEA n	Pre-SEA Mean	Post-SEA n	Post-SEA Mean	p-Value
a) D>10 ppt (n=471) (R^2=0.06)	Low	84	3.25	43	2.28	0.026
	Medium	115	2.83	116	2.12	
	High	45	2.69	68	2.34	
b) D>5 ppt (n=695) (R^2=0.07)	Low	108	2.85	75	1.99	0.033
	Medium	206	3.06	144	2.08	
	High	61	2.69	101	2.31	

Total Conceptions (Full Siblings)

Model 2: Conceptions of Ranch Hands - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 3-19 [a] and [b]), there is significant variation in the association between total conceptions and current dioxin with time since duty in SEA and time of conception among full siblings fathered by Ranch Hands having more than 10 ppt (p=0.048) and more than 5 ppt (p=0.025) current dioxin. The significance for both exposure restrictions is due to inconsistent trends with dioxin in pre-SEA and post-SEA conceptions.

Table 3-19

Pre-Post SEA Total Conceptions

Variable: Total Conceptions
Restrictions: Full Siblings of Ranch Hands
Model 2: Log_2(Current Dioxin), Time

Exposure Restriction	Time of Conception	Time Since SEA (years)	Mean total Conceptions (n) Current Dioxin Low	Medium	High	p-value
a) D>10 ppt (n=473) (R^2=0.07)	Pre-SEA	≤18.6	3.04 (49)	3.07 (60)	2.17 (18)	0.048
		>18.6	3.26 (31)	2.72 (61)	3.12 (26)	
	Post-SEA	≤18.6	2.07 (27)	2.27 (59)	2.34 (32)	
		>18.6	2.21 (19)	2.11 (53)	2.24 (38)	
b) D>5 ppt (n=695) (R^2=0.08)	Pre-SEA	≤18.6	2.87 (55)	3.05 (109)	2.48 (29)	0.025
		>18.6	2.91 (54)	2.97 (94)	3.06 (34)	
	Post-SEA	≤18.6	2.02 (40)	2.07 (81)	2.51 (47)	
		>18.6	1.88 (34)	2.01 (68)	2.28 (50)	

Total Conceptions (Full Siblings)

Model 3: Conceptions of Ranch Hands and Comparisons - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 3-20), there is no significant variation in the overall association between total conceptions and categorized current dioxin with time of conception (p=0.174). The change in the average number of conceptions from pre-SEA to post-SEA fathered by Ranch Hands in the High category (2.79-2.39=0.40) is significantly less than that

(2.91-2.07=0.84) of Comparisons in the Background category (p=0.036). Corresponding contrasts of pre-SEA to post-SEA changes in conceptions of Ranch Hands in the Low (p=0.483) and Unknown (p=0.841) categories with changes among conceptions of Comparisons in the Background category are not significant.

Table 3-20

Pre-Post SEA Total Conceptions

Variable: Total Conceptions
Restrictions: Full Siblings of Ranch Hands and Comparisons
Model 3: Categorized Current Dioxin

	Time of Conception Relative to the Father's Duty in SEA					
Exposure Category	Pre-SEA n	Pre-SEA Mean	Post-SEA n	Post-SEA Mean	Exposure Contrast	p-Value
Background	499	2.91	475	2.07	All Exp Categ	0.174
Unknown	209	2.89	145	1.92	Unk vs Bkgd	0.841
Low	97	2.91	82	2.05	Low vs Bkgd	0.483
High	63	2.79	97	2.39	High vs Bkgd	0.036
Total	868		799		(R^2=0.08)	

3.3 Post-SEA Exposure Analyses

The same series of analyses were carried out on conceptions occurring during or after the father's return from duty in SEA. The results are shown in Tables 3-21 through 3-38. Each analysis is carried out without and again with restriction to full siblings.

Miscarriage (All Conceptions)

Model 1: Conceptions of Ranch Hands - Log_2(Initial Dioxin)

Without adjustment for covariates (Table 3-21 [a] and [b]), there is no significant association between miscarriage and initial dioxin among conceptions of Ranch Hands having more than 10 ppt (p=0.588) or more than 5 ppt (p=0.378) current dioxin.

After adjustment for covariates (Table 3-21 [c]), there is significant variation in the association between miscarriage and initial dioxin with the mother's age among conceptions fathered by Ranch Hands having more than 10 ppt (p=0.005). The basis for this variation is displayed in Appendix Table A-1. These stratified analyses found no significant association between miscarriage and initial dioxin among conceptions of mothers who were less than 27 years at the time of the conception (p=0.198), or among conceptions of mothers who were more than 27 years at the time of the conception (p=0.867).

After adjustment for covariates (Table 3-21 [d]), there is no significant association between miscarriage and initial dioxin among conceptions fathered by Ranch Hands having more than 5 ppt (p=0.398) current dioxin.

Table 3-21

Post-SEA Counts and Rates of Miscarriage

Variable: Miscarriage
Restrictions: All Conceptions of Ranch Hands
Conceptions during or after the Father's Duty in SEA
Model 1: Log(Initial Dioxin)

Ranch Hands - Log(Initial) - Unadjusted

Exposure Restriction	Initial Dioxin	Miscarriage n	Miscarriage Rate (n)	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=637)	Low	136	154.4(21)	1.05(0.88,1.26)	0.588
	Medium	310	158.1(49)		
	High	191	157.1(30)		
b) D>5 ppt (n=871)	Low	199	135.7(27)	1.06(0.93,1.21)	0.378
	Medium	392	155.6(61)		
	High	280	160.7(45)		

Table 3-21 (Continued)

Ranch Hands - Log2(Initial) - Adjusted

Exposure Restriction	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=569)	****	****	M-AGE*DIOXIN (p=0.005) RACE(p=0.017) OCC(p=0.039) C-TIME(p=0.054)
d) D>5 ppt (n=767)	1.07(0.92,1.25)	0.398	OCC(p=0.059)

Miscarriage (All Conceptions)

Model 2: Conceptions of Ranch Hands - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 3-22 [a]), there is significant variation in the association between miscarriage and current dioxin with time since duty in SEA among conceptions fathered by Ranch Hands having more than 10 ppt current dioxin (p=0.022). Among conceptions of Ranch Hands having late tours, the association between miscarriage and current dioxin is borderline significant (OR=1.31, 95% CI 0.98-1.74, p=0.066) and among conceptions of Ranch Hands having early tours, the association is not significant (OR=0.84, 95% CI 0.66-1.08, p=0.170). The significance is caused by the first of these odds ratios being greater than one and the second being less than one.

Without adjustment for covariates (Table 3-22 [b]), there is no significant variation in the association between miscarriage and current dioxin with time duty in SEA among conceptions fathered by Ranch Hands having more than 5 ppt current dioxin (p=0.250). Furthermore, there is no significant association between miscarriage and current dioxin among conceptions of Ranch Hands with late (p=0.220) or early (p=0.712) tours.

After adjustment for covariates (Table 3-22 [c]), there is significant variation in the association between miscarriage and current dioxin with time and the father's military occupation in SEA (p=0.018). The basis for this variation is displayed in Appendix Table A-1. These stratified analyses found that for Ranch Hands officers, there is a significant change in the association between miscarriage and current dioxin with time since duty in SEA (p=0.022). Among the officers having late tours, the association between miscarriage and current dioxin is not significant (OR=4.55, 95% CI 0.40-52.3, p=0.224) while the same association is borderline significant (OR=0.06, 95% CI 0.002-1.43, p=0.075) for those with early tours. For the enlisted ground personnel, there is a borderline significant change in the association between

miscarriage and current dioxin with time since duty in SEA (p=0.069). Among the enlisted ground personnel having late tours, the association between miscarriage and current dioxin is significant (OR=1.46, 95% CI 1.04-2.05, p=0.030) while for those with early tours this association is not significant (OR=0.94, 95% CI 0.65-1.34, p=0.712). There is no significant change in the association between miscarriage and current dioxin with time since duty in SEA (p=0.218) for the enlisted flyers and there is no significant association between miscarriage and current dioxin among those with late (p=0.376) or early tours (p=0.451).

After adjustment for covariates (Table 3-22 [d]), there is significant variation in the association between miscarriage and current dioxin with time since duty in SEA and the father's military occupation in SEA (p=0.044). The basis for this variation is displayed in Appendix Table A-1. These stratified analyses found that for the enlisted flyers is there a significant change in the association between miscarriage and current dioxin with time since duty in SEA (p=0.021). For this stratum there is no significant association between miscarriage and current dioxin among conceptions fathered by Ranch Hands with late tours (p=0.223) while there is a significant positive association for those with early tours (OR=2.58, 95% CI 1.01-6.57, p=0.043). No significant associations were found in the other occupational strata.

If the above interaction is ignored, there is no significant change in the association between miscarriage and current dioxin with time since duty in SEA (p=0.295). Furthermore, there is no significant association between miscarriage and current dioxin among conceptions fathered by Ranch Hands with late (p=0.130) or early (p=0.959) tours.

Table 3-22

Post-SEA Counts and Rates of Miscarriage

Variable: Miscarriage
Restrictions: All Conceptions of Ranch Hands
Conceptions during or after the
Father's Duty in SEA
Model 2: Log_2(Current Dioxin), Time

Ranch Hands - Log_2(Current), Time - Unadjusted

Exposure Restriction	Time Since SEA (years)	Miscarriage Rate (No./n) Current Dioxin Low	Medium	High	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=638)						0.022
	≤18.6	92.1 (7/76)	136.6 (22/161)	168.5 (15/89)	1.31(0.98,1.74)	0.066
	>18.6	237.3 (14/59)	198.6 (29/146)	121.5 (13/107)	0.84(0.66,1.08)	0.170
b) D>5 ppt (n=871)						0.250
	≤18.6	127.1 (15/118)	132.7 (28/211)	154.4 (21/136)	1.13(0.93,1.38)	0.220
	>18.6	103.9 (8/77)	202.2 (37/183)	164.4 (24/146)	0.97(0.81,1.16)	0.712

Table 3-22 (Continued)

Ranch Hands - Log_2(Current), Time - Adjusted

Exposure Restriction	Time Since SEA (years)	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=570)				OCC*TIME* DIOXIN(p=0.018)
	≤18.6	****	****	RACE(p=0.014)
	>18.6	****	****	
d) D>5 ppt (n=767)			0.295***	OCC*TIME* DIOXIN(p=0.044)
	≤18.6	1.17(0.95,1.43)***	0.130***	
	>18.6	1.01(0.82,1.23)***	0.959***	

Miscarriage (All Conceptions)

Model 3: Conceptions of Ranch Hands and Comparisons - Categorized Current Dioxin

Without adjustment for covariates (Table 3-23 [a]), there is no significant overall association between miscarriage and categorized dioxin (p=0.772). Furthermore, the miscarriage rates in conceptions fathered by Ranch Hands in the High (p=0.380), Low (p=0.788) and Unknown (p=0.441) categories are not significantly different from the rate in conceptions fathered by Comparisons in the Background category.

After adjustment for covariates (Table 3-23 [b]), there is significant variation in the association between post-SEA miscarriage and categorized current dioxin with the mother's age at the time of the conception (p=0.038). The basis for this variation is displayed in Appendix Table A-1. These stratified analyses found no significant overall association between miscarriage and categorized current dioxin among conceptions of mothers who were less than 27 years at the time of the conception (p=0.273). Among such conceptions, there is a borderline significant difference between the miscarriage rate in conceptions of Ranch Hands in the High category and the rate in conceptions of Comparisons in the Background category (OR=1.57, 95% CI 0.97-2.54, p=0.064). Corresponding contrasts of miscarriage rates in conceptions of Ranch Hands in the Unknown (p=0.238) and Low (p=0.810) categories with the rate in conceptions of Comparisons in the Background category are not significant. There is no significant association between miscarriage and categorized current dioxin in conceptions of mothers who were older than 27

years at the time of the conception (p=0.586). Furthermore, among such conceptions, there is no significant difference between the miscarriage rates in conceptions fathered by Ranch Hands in the High (p=0.697) or Low (p=0.852) or Unknown (p=0.204) categories with the rate in conceptions fathered by Comparisons in the Background category.

If this interaction is ignored (Table 3-23 [b]), there is no significant overall association between miscarriage and categorized current dioxin (p=0.678). Furthermore, there is no significant difference between the miscarriage rate in conceptions of Ranch Hands in the High (p=0.230), Low (p=0.750) or Unknown (p=0.933) categories and the rate in conceptions of Comparisons in the Background category.

Table 3-23

Post-SEA Counts and Rates of Miscarriage

Variable: Miscarriage
Restrictions: All Conceptions of Ranch Hands and Comparisons Conceptions during or after the Father's Duty in SEA
Model 3: Categorized Current Dioxin

a) **Unadjusted**

Exposure Category	n	Miscarriage Rate (n)	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	1235	139.3(172)	All Exp Categ		0.772
Unknown	367	155.3(57)	Unk vs Bkgd	1.14(0.82,1.57)	0.441
Low	212	146.2(31)	Low vs Bkgd	1.06(0.70,1.60)	0.788
High	282	159.6(45)	High vs Bkgd	1.17(0.82,1.68)	0.380
Total	2096				

b) **Adjusted**

Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	1044	All Exp Categ		0.678***	SMOKE(p=0.001)
Unknown	313	Unk vs Bkgd	0.98(0.68,1.42)***	0.933***	M-AGE*DIOXIN
Low	189	Low vs Bkgd	1.07(0.69,1.67)***	0.750***	(p=0.038)
High	250	High vs Bkgd	1.26(0.86,1.86)***	0.230***	
Total	1796				

Miscarriage (Full Siblings)

Model 1: Conceptions of Ranch Hands - Log_2(Initial Dioxin)

Without adjustment for covariates (Table 3-24 [a] and [b]), there is no significant association between miscarriage and initial dioxin among full siblings fathered by Ranch Hands with more than 10 ppt (p=0.463) or more than 5 ppt (p=0.713) current dioxin.

After adjustment for covariates (Table 3-24 [c]), there is significant variation in the association between miscarriage and initial dioxin with the mother's age at the time of the conception (p=0.001) in full siblings fathered by Ranch Hands with more than 10 ppt current dioxin. The basis for this variation is displayed in Appendix Table A-1. These stratified analyses found that relative risks in conceptions of mothers less than 27 (p=0.146) and older than 27 years (p=0.569) at the time of the conception were not significant.

After adjustment for covariates (Table 3-24 [d]), there is no significant association between miscarriage and initial dioxin among full siblings fathered by Ranch Hands with more than 5 ppt current dioxin (p=0.457).

Table 3-24

Post-SEA Counts and Rates of Miscarriage

Variable: Miscarriage
Restrictions: Full Siblings Conceptions of Ranch Hands
Conceptions during or after the
Father's Duty in SEA
Model 1: Log_2(Initial Dioxin)

Ranch Hands - Log_2(Initial Dioxin) - Unadjusted

Exposure Restriction	Initial Dioxin	n	Miscarriage Rate (n)	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=503)	Low	98	153.1(15)	1.08(0.88,1.32)	0.463
	Medium	246	130.1(32)		
	High	159	157.2(25)		
b) D>5 ppt (n=682)	Low	149	154.4(23)	1.03(0.89,1.19)	0.713
	Medium	300	140.0(42)		
	High	233	150.2(35)		

Table 3-24 (Continued)

Ranch Hands - Log_2(Initial Dioxin) - Adjusted

Exposure Restriction	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=398)	****	****	M-AGE* DIOXIN(p=0.001)
d) D>5 ppt (n=520)	1.06(0.91,1.24)	0.457	None

Miscarriage (Full Siblings)

Model 2: Conceptions of Ranch Hands - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 3-25 [a]), there is borderline significant variation in the association between miscarriage and the father's current dioxin level with time since duty in SEA among full siblings fathered by Ranch Hands with more than 10 ppt current dioxin (p=0.076). Among conceptions of Ranch Hands having late tours, the association between miscarriage and current dioxin is positive and not significant (p=0.366) and among conceptions of Ranch Hands early tours, the association is negative and not significant (p=0.119).

Without adjustment for covariates (Table 3-25 [b]), there is no significant variation in the association between miscarriage and current dioxin with time since duty in SEA among full siblings fathered by Ranch Hands with more than 5 ppt current dioxin (p=0.528). Furthermore, the association between miscarriage and current dioxin is not significant among conceptions of Ranch Hands having late (p=0.722) or early (p=0.594) tours.

After adjustment for covariates (Table 3-25 [c]), there is significant variation in the association between miscarriage and current dioxin with time since duty in SEA and the father's military occupation in SEA (p=0.027). The basis for these significances are displayed in Appendix Table A-1. These stratified analyses found that the association between miscarriage and the father's current dioxin level is not significant among conceptions fathered by Ranch Hands having late or early tours for any of the father's military occupations in SEA. If this interaction is ignored, then there is a significant association between miscarriage and current dioxin in conceptions fathered by Ranch Hands having late tours (OR=1.57, 95% CI 1.12-2.21, p=0.009) but no significant association in conceptions fathered by Ranch Hands having early tours (p=0.650).

After adjustment for covariates (Table 3-25 [d]), there is significant variation in the association between miscarriage and current dioxin with time since duty in SEA and the father's military occupation in SEA (p=0.017). The basis for these significances are displayed in Appendix Table A-1. These stratified analyses found borderline significantly High relative risks in conceptions fathered by officers having late tours (OR=3.07, 95% CI 0.86-10.9, p=0.083) and in conceptions fathered by enlisted flyers having early tours (OR=2.06, 95% CI 0.98-4.33, p=0.054). None of the remaining relative risks were significant.

If this interaction is ignored (Table 3-25 [d]), there is no significant overall association between miscarriage and current dioxin with time since duty in SEA in conceptions fathered by Ranch Hands with more than 5 ppt current dioxin (p=0.482). Furthermore, there is no significant association between miscarriage and current dioxin in conceptions of Ranch Hands with late (p=0.556) or early (p=0.746) tours.

Table 3-25

Post-SEA Counts and Rates of Miscarriage

Variable: Miscarriage
Restrictions: Full Siblings of Ranch Hands
Conceptions during or after the
Father's Duty in SEA
Model 2: Log_2(Current Dioxin), Time

Ranch Hands - Log_2(Current Dioxin), Time - Unadjusted

Exposure Restriction	Time Since SEA (years)	Miscarriage Rate (No./n) Current Dioxin Low	Medium	High	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=504)						0.076
	≤18.6	89.3 (5/56)	126.9 (17/134)	146.7 (11/75)	1.29(0.94,1.78)	0.119
	>18.6	238.1 (10/42)	169.6 (19/112)	117.6 (10/85)	0.88(0.66,1.17)	0.366
b) D>5 ppt (n=682)						0.528
	≤18.6	148.1 (12/81)	125.0 (21/168)	144.1 (17/118)	1.06(0.85,1.33)	0.594
	>18.6	109.4 (7/64)	182.5 (25/137)	157.9 (18/114)	0.96(0.78,1.18)	0.722

Table 3-25 (Continued)

Ranch Hands - Log_2(Current Dioxin), Time - Adjusted

Exposure Restriction	Time Since SEA (years)	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=469)			0.095***	OCC*TIME* DIOXIN(p=0.027)
	≤18.6	1.57(1.12,2.21)***	0.009***	
	>18.6	0.92(0.66,1.30)***	0.650***	
d) D>5 ppt (n=624)			0.482***	OCC*TIME* DIOXIN(p=0.017)
	≤18.6	1.08(0.84,1.39)***	0.556***	
	>18.6	0.96(0.76,1.22)***	0.746***	

Miscarriage (Full Siblings)

Model 3: Conceptions of Ranch Hands and Comparisons - Categorized Current Dioxin

Without adjustment for covariates (Table 3-26 [a]), there is no significant overall association between miscarriage and categorized current dioxin in full siblings (p=0.497). Furthermore, there is no significant difference between the miscarriage rate in conceptions fathered by Ranch Hands in the High (p=0.746), Low (p=0.307) or Unknown (p=0.354) categories with the rate in conceptions fathered by Comparisons in the Background category.

After adjustment for covariates (Table 3-26 [b]), there is no significant overall association between miscarriage and categorized current dioxin in full siblings (p=0.407). Furthermore, there is no significant difference between the miscarriage rate in conceptions fathered by Ranch Hands in the High (p=0.443), Low (p=0.184) or Unknown (p=0.986) categories with the rate in conceptions fathered by Comparisons in the Background category.

Table 3-26

Post-SEA Counts and Rates of Miscarriage

Variable: Miscarriage
Restrictions: Full Siblings of Ranch Hands and Comparisons
Conceptions during or after the
Father's Duty in SEA
Model 3: Categorized Current Dioxin

a) Unadjusted

Exposure Category	n	Miscarriage Rate (n)	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	982	142.6(140)	All Exp Categ		0.497
Unknown	279	164.9(46)	Unk vs Bkgd	1.19(0.83,1.71)	0.354
Low	168	113.1(19)	Low vs Bkgd	0.77(0.46,1.28)	0.307
High	232	150.9(35)	High vs Bkgd	1.07(0.72,1.60)	0.746
Total	1661				

b) Adjusted

Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	860	All Exp Categ		0.407	SMOKE(p=0.047)
Unknown	246	Unk vs Bkgd	1.00(0.66,1.50)	0.986	
Low	156	Low vs Bkgd	0.69(0.40,1.20)	0.184	
High	215	High vs Bkgd	1.18(0.78,1.78)	0.443	
Total	1477				

Total adverse outcome (All Conceptions)

Model 1: Conceptions of Ranch Hands - Log_2(Initial Dioxin)

Without adjustment for covariates (Table 3-27 [a] and [b]), there is no significant association between total adverse outcome and initial dioxin among conceptions fathered by Ranch Hands having more than 10 ppt (p=0.827) or more than 5 ppt (p=0.880) current dioxin.

After adjustment for covariates (Table 3-27 [c]), there is significant variation in the association between total adverse outcome and initial dioxin level with the mother's age at the time of conception in conceptions fathered by Ranch Hands having more than 10 ppt (p=0.015). The basis for this interaction is displayed in Appendix Table A-1. These stratified analyses found a borderline significant positive association among mothers less than 27 years of age (p=0.106) while the association was not significant among mothers older than 27.

After adjustment for covariates (Table 3-27 [d]), there is significant variation in the association between total adverse outcome and initial dioxin with the father's military occupation (p=0.009) and race (p=0.043) among conceptions fathered by Ranch Hands having more than 5 ppt current dioxin. The basis for this interaction is displayed in Appendix Table A-1. These stratified analyses found a significant positive association between total adverse outcome and initial dioxin among conceptions fathered by nonblack officers (p=0.017) while the same association is borderline significant among conceptions of Black enlisted personnel (p=0.088). None of the other strata exhibited a significant association between total adverse outcome and initial dioxin.

Table 3-27

Post-SEA Counts and Rates of Total Adverse Outcome

Variable: Total Adverse Outcome
Restrictions: All Conceptions of Ranch Hands
Conceptions during or after the Father's Duty in SEA
Model 1: Log_2(Initial Dioxin)

Log_2(Initial Dioxin) - Unadjusted

Exposure Restriction	Initial Dioxin	n	Adverse Rate(n)	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=619)	Low	129	178.3(23)	0.98(0.82,1.17)	0.827
	Medium	303	191.4(58)		
	High	187	160.4(30)		
b) D>5 ppt (n=841)	Low	188	175.5(33)	0.99(0.87,1.12)	0.880
	Medium	379	187.3(71)		
	High	274	171.5(47)		

Table 3-27 (Continued)

Ranch Hands - Log_2(Initial Dioxin) - Adjusted

Exposure Restriction	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=555)	****	****	RACE(p=0.018) SMOKE(p=0.026) M-AGE*DIOXIN (p=0.015) OCC(p=0.020) C-TIME(p=0.074)
d) D>5 ppt (n=742)	****	****	RACE*DIOXIN (p=0.043) OCC*DIOXIN (p=0.009)

Total Adverse Outcome (All Conceptions)

Model 2: Conceptions of Ranch Hands - Log_2(Current Dioxin) and Time

Without adjustment for covariates (Table 3-28 [a]), there is significant variation in the association between total adverse outcomes and current dioxin with time since duty in SEA among post-SEA conceptions fathered by Ranch Hands having more than 10 ppt current dioxin (p=0.012). This significance is due to a borderline significant decreased risk among conceptions of Ranch Hands with early tours (OR=0.77, 95% CI 0.60-0.98, p=0.032) and a nonsignificant increased risk in conceptions of Ranch Hands with late tours (OR=1.23, 95% CI 0.93-1.62, p=0.150).

Without adjustment for covariates (Table 3-28 [b]), there is no significant variation in the association between total adverse outcomes and current dioxin with time since duty in SEA among conceptions fathered by Ranch Hands having more than 5 ppt current dioxin (p=0.316). Furthermore, there is no significant association between adverse outcome and current dioxin among conceptions of Ranch Hands with late (p=0.710) or early (p=0.285) tours.

After adjustment for covariates (Table 3-28 [c]), there is significant variation in the association between total adverse outcome and current dioxin with time since duty in SEA with the father's military occupation in conceptions of Ranch Hands having more than 10 ppt current dioxin (p=0.034). The basis for this variation in risk is displayed in Appendix Table A-1. These stratified analyses found that in conceptions fathered by officers and enlisted ground personnel, the association between total adverse outcome and current dioxin was positive among conceptions of fathers having late tours and the association was negative among conceptions of fathers having early tours.