

There is insufficient data to assess the significance of the association between ear, face and neck anomalies and initial dioxin among full sibling children of Ranch Hands with adjustment for covariates (Table 6-22 [c] and [d]).

Table 6-22

Post-SEA Counts and Rates of
Ear, Face and Neck Anomalies

Variable: Ear, Face and Neck Anomalies
Restrictions: Full Siblings of Ranch Hands
Children Conceived during or after the
Father's Duty in SEA
Model 1: $\text{Log}_2(\text{Initial Dioxin})$

Ranch Hands - Log ₂ (Initial Dioxin) - Unadjusted						
Exposure Restriction	Initial Dioxin	n	Abnormal Number	Rate	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=420)	Low	78	0	0.0	1.55(0.86,2.81)	0.150
	Medium	206	4	19.4		
	High	136	3	22.1		
b) D>5 ppt (n=557)	Low	114	3	26.3	1.15(0.74,1.76)	0.540
	Medium	245	3	12.2		
	High	198	4	20.2		
Ranch Hands - Log ₂ (Initial Dioxin) - Adjusted						
Exposure Restriction	Adj. Relative Risk (95% C.I.)		p-Value		Covariate Remarks	
c) D>10 ppt (n=390)	No adjusted analyses, only 7 defects total					
d) D>5 ppt (n=513)	No adjusted analyses, only 10 defects total					

Anomalies of the Ear, Face and Neck (Full Siblings)

Model 2: Children of Ranch Hands - \log_2 (Current Dioxin) and Time

Without adjustment for covariates (Table 6-23 [a]), there is no significant variation in the association between ear, face and neck anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands having more than 10 ppt current dioxin ($p=0.528$). Furthermore, there is no association between ear, face and neck anomalies and current dioxin among children of Ranch Hands with late ($p=0.789$) or early ($p=0.254$) tours.

Without adjustment for covariates (Table 6-23 [b]), there is significant variation in the association between ear, face and neck anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands having more than 5 ppt current dioxin ($p=0.014$). This finding is caused by increasing rates in children of Ranch Hands with early tours (OR=1.67, 95% CI 0.96-2.90, $p=0.069$) and decreasing rates in children of Ranch Hands with late tours (OR=0.43, 95% CI 0.14-1.31, $p=0.139$).

There is insufficient data to assess the significance of variation in the association between ear, face and neck anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands with adjustment for covariates (Table 6-23 [c] and [d]).

Table 6-23

**Post-SEA Counts and Rates of
Ear, Face and Neck Anomalies**

Variable: Ear, Face and Neck Anomalies
 Restrictions: Full Siblings of Ranch Hands
 Children Conceived during or after the
 Father's Duty in SEA
 Model 2: $\text{Log}_2(\text{Current Dioxin}), \text{Time}$

Ranch Hands - $\text{Log}_2(\text{Current Dioxin}), \text{Time}$ - Unadjusted

Exposure Restriction	Time Since SEA (years)	Anomaly Rate (No./n) Current Dioxin			Est. Relative Risk (95% C.I.)	p-Value
		Low	Medium	High		
a) D>10 ppt (n=421)						0.528
	≤18.6	0.0 (0/47)	8.7 (1/115)	0.0 (0/64)	0.76(0.10,5.79)	0.789
	>18.6	35.7 (1/28)	21.7 (2/92)	40.0 (3/75)	1.45(0.77,2.73)	0.254
b) D>5 ppt (n=557)						0.014
	≤18.6	33.9 (2/59)	13.9 (2/144)	0.0 (0/98)	0.43(0.14,1.31)	0.139
	>18.6	0.0 (0/53)	18.9 (2/106)	41.2 (4/97)	1.67(0.96,2.90)	0.069

Ranch Hands - $\text{Log}_2(\text{Current Dioxin}), \text{Time}$ - Adjusted

Exposure Restriction	Time Since SEA (years)	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=391)		No adjusted analyses, only 7 defects total		
d) D>5 ppt (n=513)		No adjusted analyses, only 10 defects total		

Anomalies of the Ear, Face and Neck (Full Siblings)

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

Without adjustment for covariates (Table 6-24 [a]), there is no significant overall association between ear, face and neck anomalies and categorized current dioxin among full siblings ($p=0.889$). Furthermore, there is no significant difference between the rates of ear, face and neck anomalies among children of Ranch Hands in the High ($p=0.474$), Low ($p=0.997$) and Unknown ($p=0.617$) categories and the rate among children of Comparisons in the Background category.

After adjustment for covariates (Table 6-24 [b]), there is no significant overall association between ear, face and neck anomalies and categorized current dioxin among full siblings ($p=0.808$). Furthermore, there is no significant difference between the rates of ear, face and neck anomalies among children of Ranch Hands in the High ($p=0.430$), Low ($p=0.493$) and Unknown ($p=0.537$) categories and the rate among children of Comparisons in the Background category.

Table 6-24

Post-SEA Counts and Rates of Ear, Face and Neck Anomalies

Variable: Ear, Face and Neck Anomalies
Restrictions: Full Siblings of Ranch Hands and Comparisons
Children Conceived during or after the
Father's Duty in SEA
Model 3: Categorized Current Dioxin

a) Unadjusted

Exposure Category	n	Abnormal Number	Rate	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	812	11	13.5	All Exp Categ		0.889
Unknown	221	4	18.1	Unk vs Bkgd	1.34(0.42, 4.26)	0.617
Low	148	2	13.5	Low vs Bkgd	1.00(0.22, 4.55)	0.997
High	195	4	20.5	High vs Bkgd	1.52(0.48, 4.85)	0.474
Total	1376					

Table 6-24 (Continued)

b) Adjusted

Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	715	All Exp Categ		0.808	OCC(p=0.090)
Unknown	199	Unk vs Bkgd	1.45(0.45,4.67)	0.537	DRINK(p=0.086)
Low	137	Low vs Bkgd	1.58(0.43,5.82)	0.493	
High	180	High vs Bkgd	1.60(0.50,5.17)	0.430	
Total	1231				

Anomalies of the Circulatory System and Heart (All Children)

Model 1: Children of Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$

Without adjustment for covariates (Table 6-25 [a]), there is a significant negative association between anomalies of the circulatory system and heart and initial dioxin among children of Ranch Hands having more than 10 ppt current dioxin (OR=0.58, 95% CI 0.33-1.03, p=0.042).

Without adjustment for covariates (Table 6-25 [b]), there is no significant association between circulatory system and heart anomalies and initial dioxin among children of Ranch Hands with more than 5 ppt current dioxin (p=0.686).

There is insufficient data to assess the significance of the association between circulatory system and heart anomalies and fathers initial dioxin among children of Ranch Hands with adjustment for covariates (Table 13-25 [c] and [d]).

Table 6-25

**Post-SEA Counts and Rates of
Circulatory System and Heart Anomalies**

Variable: Circulatory System and Heart Anomalies
 Restrictions: All Children of Ranch Hands
 Children Conceived during or after the
 Father's Duty in SEA
 Model 1: $\text{Log}_2(\text{Initial Dioxin})$

Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$ - Unadjusted						
Exposure Restriction	Initial Dioxin	n	Abnormal Number	Rate	Est. Relative Risk(95% C.I.)	p-Value
a) D>10 ppt (n=508)	Low	106	3	28.3	0.58(0.33,1.03)	0.042
	Medium	245	9	36.7		
	High	157	1	6.4		
b) D>5 ppt (n=690)	Low	155	2	12.9	0.92(0.63,1.36)	0.686
	Medium	308	10	32.5		
	High	227	2	8.8		

Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$ - Adjusted			
Exposure Restriction	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=458)	No adjusted analyses, only 13 defects total		
d) D>5 ppt (n=616)	No adjusted analyses, only 14 defects total		

Anomalies of the Circulatory System and Heart (All Children)

Model 2: Children of Ranch Hands - $\text{Log}_2(\text{Current Dioxin})$ and Time

Without adjustment for covariates (Table 6-26 [a]), there is no significant variation in the association between anomalies of the circulatory system and heart and current dioxin with time since duty in SEA among children of Ranch Hands having more than 10 ppt current dioxin ($p=0.589$). However, the negative association between anomalies of the circulatory system and heart and current dioxin among children of Ranch Hands with early tours is borderline significant (OR=0.45, 95% CI 0.19-1.05, $p=0.065$) and the association is not significant among children of Ranch Hands with late tours ($p=0.318$).

Without adjustment for covariates (Table 6-26 [b]), there is no significant variation in the association between anomalies of the circulatory system and heart and current dioxin with time since duty in SEA among children of Ranch Hands having more than 5 ppt current dioxin ($p=0.730$). Furthermore, the association between anomalies of the circulatory system and heart and current dioxin among children of Ranch Hands with early ($p=0.543$) and late ($p=0.929$) tours are not significant.

There is insufficient data to assess the variation in the association between anomalies of the circulatory system and heart and current dioxin with time since duty in SEA among children of Ranch Hands (Table 6-26 [c] and [d]).

Table 6-26

Post-SEA Counts and Rates of
Circulatory System and Heart Anomalies

Variable: Circulatory System and Heart Anomalies
Restrictions: All Children of Ranch Hands
Children Conceived during or after the
Father's Duty in SEA
Model 2: $\text{Log}_2(\text{Current Dioxin})$, Time

Ranch Hands - $\text{Log}_2(\text{Current Dioxin})$, Time - Unadjusted						
Exposure Restriction	Time Since SEA (years)	Anomaly Rate (No./n)			Est. Relative Risk (95% C.I.)	p-Value
		Low	Medium	High		
a) D>10 ppt (n=509)						0.589
	≤18.6	16.1 (1/62)	37.3 (5/134)	0.0 (0/72)	0.63(0.26,1.56)	0.318
	>18.6	50.0 (2/40)	37.0 (4/108)	10.8 (1/93)	0.45(0.19,1.05)	0.065
b) D>5 ppt (n=690)						0.730
	≤18.6	11.1 (1/90)	28.7 (5/174)	9.1 (1/110)	0.97(0.54,1.75)	0.929
	>18.6	0.0 (0/63)	44.1 (6/136)	8.5 (1/117)	0.85(0.49,1.45)	0.543

Table 6-26 (Continued)

Ranch Hands - Log₂(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=459)		No adjusted analyses, only 13 defects total		
d) D>5 ppt (n=616)		No adjusted analyses, only 14 defects total		

Anomalies of the Circulatory System and Heart (All Children)

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

Without adjustment for covariates (Table 6-27 [a]), there is a borderline significant overall association between anomalies of the circulatory system and heart and categorized current dioxin ($p=0.067$). The rate of circulatory system and heart anomalies among children of Ranch Hands in the Low current dioxin category (46.0 per 1000) is significantly greater than the rate among children of Comparisons in the Background category (16.3 per 1000), OR=2.91, 95% CI 1.22-6.90, $p=0.016$. Corresponding contrasts between children of Ranch Hands in the High ($p=0.408$) and Unknown ($p=0.801$) categories with children of Comparisons in the Background category are not significant.

After adjustment for covariates (Table 6-27 [b]), there is no significant overall association between anomalies of the circulatory system and heart and categorized current dioxin ($p=0.180$). Furthermore, the rates of circulatory system and heart anomalies among children of Ranch Hands in the High ($p=0.280$), Low ($p=0.124$) and Unknown ($p=0.785$) categories are not significantly different from the rate among children of Comparisons in the Background category.

Table 6-27

**Post-SEA Counts and Rates of
Circulatory System and Heart Anomalies**

Variable: Circulatory System and Heart Anomalies
 Restrictions: All Children of Ranch Hands and Comparisons
 Children Conceived during or after the
 Father's Duty in SEA
 Model 3: Categorized Current Dioxin

Current Dioxin (Categorized Within Group) - Unadjusted						
Exposure Category	n	Abnormal Number	Rate	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	981	16	16.3	All Exp Categ		0.067
Unknown	282	4	14.2	Unk vs Bkgd	0.87(0.29, 2.62)	0.801
Low	174	8	46.0	Low vs Bkgd	2.91(1.22, 6.90)	0.016
High	227	2	8.8	High vs Bkgd	0.54(0.12, 2.35)	0.408
Total	1664					

Current Dioxin (Categorized Within Group) - Adjusted						
Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate	Remarks
Background	843	All Exp Categ		0.180	RACE	(p=0.081)
Unknown	246	Unk vs Bkgd	0.85(0.27, 2.69)	0.785	OCC	(p=0.002)
Low	156	Low vs Bkgd	2.16(0.81, 5.74)	0.124	DRINK	(p=0.019)
High	203	High vs Bkgd	0.32(0.04, 2.52)	0.280	C-TIME	(p=0.001)
Total	1448					

Anomalies of the Circulatory System and Heart (Full Siblings)

Model 1: Children of Ranch Hands - Log₂(Initial Dioxin)

Without adjustment for covariates (Table 6-28 [a] and [b]), there is a borderline significantly negative association between anomalies of the circulatory system and heart and initial dioxin among full sibling children of Ranch Hands having more than 10 ppt (p=0.091), while the association is not significant in children of Ranch Hands having more than 5 ppt current dioxin (p=0.540).

There is insufficient data to assess the significance between circulatory system and heart anomalies and initial dioxin among full sibling children of Ranch Hands with adjustment for covariates (Table 6-28 [c] and [d]).

Table 6-28

Post-SEA Counts and Rates of
Circulatory System and Heart Anomalies

Variable: Circulatory System and Heart Anomalies
Restrictions: Full Siblings of Ranch Hands
Children Conceived during or after the
Father's Duty in SEA
Model 1: $\text{Log}_2(\text{Initial Dioxin})$

Ranch Hands - Log ₂ (Initial Dioxin) - Unadjusted						
Exposure Restriction	Initial Dioxin	n	Abnormal Number	Rate	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=420)	Low	78	1	12.8	0.56(0.27,1.17)	0.091
	Medium	206	7	34.0		
	High	136	0	0.0		
b) D>5 ppt (n=557)	Low	114	1	8.8	0.86(0.53,1.41)	0.540
	Medium	245	7	28.6		
	High	198	1	5.1		
Ranch Hands - Log ₂ (Initial Dioxin) - Adjusted						
Exposure Restriction	Adj. Relative Risk (95% C.I.)		p-Value		Covariate Remarks	
c) D>10 ppt (n=390)	No adjusted analyses, only 8 defects total					
d) D>5 ppt (n=513)	No adjusted analyses, only 9 defects total					

Anomalies of the Circulatory System and Heart (Full Siblings)

Model 2: Children of Ranch Hands - $\text{Log}_2(\text{Current Dioxin})$ and Time

There is insufficient data (Table 6-29) to assess the significance of variation in the association between anomalies of the circulatory system and heart and current dioxin level with time since duty in SEA among full sibling children of Ranch Hands.

Table 6-29

Post-SEA Counts and Rates of Circulatory System and Heart Anomalies

Variable: Circulatory System and Heart Anomalies
Restrictions: Full Siblings of Ranch Hands
Children Conceived during or after the
Father's Duty in SEA
Model 2: $\text{Log}_2(\text{Current Dioxin})$, Time

Ranch Hands - Log ₂ (Current Dioxin), Time - Unadjusted						
Exposure Restriction	Time Since SEA (years)	Anomaly Rate (No./n)			Est. Relative Risk (95% C.I.)	p-Value
		Current Dioxin				
		Low	Medium	High		
a) D>10 ppt (n=421)	≤18.6	0.0 (0/47)	26.1 (3/115)	0.0 (0/64)	No analyses, only 8 defects total	
	>18.6	35.7 (1/28)	43.5 (4/92)	0.0 (0/75)		
b) D>5 ppt (n=557)	≤18.6	16.9 (1/59)	20.8 (3/144)	0.0 (0/98)	No analyses, only 9 defects total	
	>18.6	0.0 (0/53)	47.2 (5/106)	0.0 (0/97)		

Table 6-29 (Continued)

Ranch Hands - Log₂(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=391)		No adjusted analyses, only 8 defects total		
d) D>5 ppt (n=513)		No adjusted analyses, only 9 defects total		

Anomalies of the Circulatory System and Heart (Full Siblings)

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

Without adjustment for covariates (Table 6-30 [a]), there is an overall significant association between anomalies of the circulatory system and heart and categorized current dioxin among full siblings ($p=0.007$). Furthermore, the rate of circulatory system anomalies in children of Ranch Hands in the Low dioxin category is significantly greater than that among children of Comparisons in the Background category, OR=2.83 95% CI 1.12-7.14, $p=0.028$. The rate in children of Ranch Hands in the Unknown category is not significantly different from that among children of Comparisons in the Background category ($p=0.931$).

After adjustment for covariates (Table 6-30 [b]), there is a significant overall association between anomalies of the circulatory system and heart and categorized current dioxin among full siblings ($p=0.034$). However, the rate of circulatory system and heart anomalies among children of Ranch Hands in the Low current dioxin category is not significantly different from that of children of Comparisons in the Background current dioxin category ($p=0.136$). The corresponding contrast of children of Ranch Hands in the Unknown category with children of Comparisons in the Background category is not significant ($p=0.889$). Because there were no cardiovascular or heart anomalies in children of Ranch Hands in the High current dioxin category, an adjusted contrast with children of Comparisons in the Background category is not possible.

Table 6-30

**Post-SEA Counts and Rates of
Circulatory System and Heart Anomalies**

Variable: Circulatory System and Heart Anomalies
 Restrictions: Full Siblings of Ranch Hands and Comparisons
 Children Conceived during or after the
 Father's Duty in SEA
 Model 3: Categorized Current Dioxin

Current Dioxin (Categorized Within Group) - Unadjusted						
Exposure Category	n	Abnormal Number	Rate	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	812	14	17.2	All Exp Categ		0.007
Unknown	221	4	18.1	Unk vs Bkgd	1.05(0.34,3.23)	0.931
Low	148	7	47.3	Low vs Bkgd	2.83(1.12,7.14)	0.028
High	195	0	0.0	High vs Bkgd	-- -- --	0.388
Total	1376					
Current Dioxin (Categorized Within Group) - Adjusted						
Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks	
Background	715	All Exp Categ		0.034	OCC(p=0.002)	
Unknown	199	Unk vs Bkgd	0.92(0.28,2.98)	0.889	DRINK(p=0.037)	
Low	137	Low vs Bkgd	2.13(0.78,5.80)	0.136	C-TIME	
High	180	High vs Bkgd	-- -- --		(p=0.005)	
Total	1231					

Anomalies of the Respiratory System (All Children)

Model 1: Children of Ranch Hands - Log₂(Initial Dioxin)

There is insufficient data (Table 6-31) to assess the association between anomalies of the respiratory system and initial dioxin level among children of Ranch Hands without or with adjustment for covariates.

Table 6-31

**Post-SEA Counts and Rates of
Respiratory System Anomalies**

Variable: Respiratory System Anomalies
 Restrictions: All Children of Ranch Hands
 Children Conceived during or after the
 Father's Duty in SEA
 Model 1: $\text{Log}_2(\text{Initial Dioxin})$

Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$ - Unadjusted

Exposure Restriction	Initial Dioxin	n	Abnormal Number	Rate	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=508)	Low	106	0	0.0	No analyses, only 2 defects total	
	Medium	245	1	4.1		
	High	157	1	6.4		
b) D>5 ppt (n=690)	Low	155	1	6.5	No analyses, only 3 defects total	
	Medium	308	1	3.2		
	High	227	1	4.4		

Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$ - Adjusted

Exposure Restriction	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=458)	No adjusted analyses, only 2 defects total		
d) D>5 ppt (n=616)	No adjusted analyses, only 3 defects total		

Anomalies of the Respiratory System (All Children)

Model 2: Children of Ranch Hands - $\text{Log}_2(\text{Current Dioxin})$ and Time

There is insufficient data (Table 6-32) to assess the variation in the association between anomalies of the respiratory system and current dioxin with time since duty in SEA among children of Ranch Hands.

Table 6-32

**Post-SEA Counts and Rates of
Respiratory System Anomalies**

Variable: Respiratory System Anomalies
 Restrictions: All Children of Ranch Hands
 Children Conceived during or after the
 Father's Duty in SEA
 Model 2: $\text{Log}_2(\text{Current Dioxin}), \text{Time}$

	Ranch Hands - Log ₂ (Current Dioxin), Time - Unadjusted					
Exposure Restriction	Time Since SEA (years)	Anomaly Rate (No./n) Current Dioxin			Est. Relative Risk (95% C.I.)	p-Value
		Low	Medium	High		
a) D>10 ppt (n=509)	≤18.6	0.0 (0/62)	0.0 (0/134)	0.0 (0/72)	No analyses, only 2 defects total	
	>18.6	0.0 (0/40)	9.3 (1/108)	10.8 (1/93)		
	b) D>5 ppt (n=690)	≤18.6	11.1 (1/90)	0.0 (0/174)	0.0 (0/110)	No analyses, only 3 defects total
>18.6		0.0 (0/63)	7.4 (1/136)	8.5 (1/117)		
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=459)		No adjusted analyses, only 2 defects total				
d) D>5 ppt (n=616)		No adjusted analyses, only 3 defects total				

Anomalies of the Respiratory System (All Children)

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

Without adjustment for covariates (Table 6-33 [a]), there is no significant overall association between anomalies of the respiratory system and categorized current dioxin ($p=0.623$). Furthermore, the rates of anomalies of the respiratory system among children of Ranch Hands in the High ($p=0.529$), Low ($p=0.397$) and Unknown categories ($p=0.211$) are not significantly different from the rate among children of Comparisons in the Background category.

There is insufficient data to assess the significance of the association between anomalies of the respiratory system and categorized current dioxin with adjustment for covariates (Table 6-33 [b]).

Table 6-33

Post-SEA Counts and Rates of Respiratory System Anomalies

Variable: Respiratory System Anomalies
Restrictions: All Children of Ranch Hands and Comparisons
Children Conceived during or after the
Father's Duty in SEA
Model 3: Categorized Current Dioxin

a) Unadjusted

Exposure Category	n	Abnormal Number	Rate	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	981	2	2.0	All Exp Categ		0.623
Unknown	282	2	7.1	Unk vs Bkgd	3.50(0.49,25.0)	0.211
Low	174	1	5.7	Low vs Bkgd	2.83(0.26,31.4)	0.397
High	227	1	4.4	High vs Bkgd	2.17(0.20,24.0)	0.529
Total	1664					

Table 6-33 (Continued)

b) Adjusted

Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	843	No adjusted analyses, only 6 defects total			
Unknown	246				
Low	156				
High	203				
Total	1448				

Anomalies of the Respiratory System (Full Siblings)

Model 1: Children of Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$

There is insufficient data (Table 6-34) to assess the association between respiratory system anomalies and fathers initial dioxin body burden among full sibling children of Ranch Hands.

Table 6-34

Post-SEA Counts and Rates of Respiratory System Anomalies

Variable: Respiratory System Anomalies
 Restrictions: Full Siblings of Ranch Hands
 Children Conceived during or after the Father's Duty in SEA
 Model 1: $\text{Log}_2(\text{Initial Dioxin})$

Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$ - Unadjusted					
Exposure Restriction	Initial Dioxin	Abnormal Number	Rate	n	Est. Relative Risk (95% C.I.) p-Value
a) D>10 ppt (n=420)	Low	78	0	0.0	No analyses, only 2 defects total
	Medium	206	1	4.9	
	High	136	1	7.4	
b) D>5 ppt (n=557)	Low	114	1	8.8	No analyses, only 3 defects total
	Medium	245	1	4.1	
	High	198	1	5.1	

Table 6-34 (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=390)	No adjusted analyses, only 2 defect total		
d) D>5 ppt (n=513)	No adjusted analyses, only 3 defects total		

Anomalies of the Respiratory System (Full Siblings)

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

There is insufficient data (Table 6-35) to assess variation in the association between anomalies of the respiratory system and current dioxin with time since duty in SEA among full sibling children of Ranch Hands.

Table 6-35

**Post-SEA Counts and Rates of
Respiratory System Anomalies**

Variable: Respiratory System Anomalies
 Restrictions: Full Siblings of Ranch Hands
 Children Conceived during or after the
 Father's Duty in SEA
 Model 2: $\text{Log}_2(\text{Current Dioxin}), \text{Time}$

Ranch Hands - Log ₂ (Current Dioxin), Time - Unadjusted						
Exposure Restriction	Time Since SEA (years)	Anomaly Rate (No./n)			Est. Relative Risk (95% C.I.)	p-Value
		Low	Medium	High		
a) D>10 ppt (n=421)	≤18.6	0.0 (0/47)	0.0 (0/115)	0.0 (0/64)	No analyses, only 2 defects total	
	>18.6	0.0 (0/28)	10.9 (1/92)	13.3 (1/75)		
b) D>5 ppt (n=557)	≤18.6	16.9 (1/59)	0.0 (0/144)	0.0 (0/98)	No analyses, only 3 defects total	
	>18.6	0.0 (0/53)	9.4 (1/106)	10.3 (1/97)		
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=391)		No adjusted analyses, only 2 defect total				
d) D>5 ppt (n=513)		No adjusted analyses, only 3 defects total				

Anomalies of the Respiratory System (Full Siblings)

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

Without adjustment for covariates (Table 6-36 [a]), there is no significant overall association between anomalies of the respiratory system and categorized current dioxin among full siblings ($p=0.605$). Furthermore, the rates of respiratory system anomalies among children of Ranch Hands in the High ($p=0.549$), Low ($p=0.409$) and Unknown ($p=0.194$) categories are not significantly different from the rate among children of Comparisons in the background category.

There is insufficient data to assess the significance of the overall association between respiratory system anomalies and categorized dioxin among full siblings with adjustment for covariates (Table 6-36 [b]).

Table 6-36

Post-SEA Counts and Rates of Respiratory System Anomalies

Variable: Respiratory System Anomalies
Restrictions: Full Siblings of Ranch Hands and Comparisons
Children Conceived during or after the
Father's Duty in SEA
Model 3: Categorized Current Dioxin

a) Unadjusted

Exposure Category	n	Abnormal Number	Rate	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	812	2	2.5	All Exp Categ		0.605
Unknown	221	2	9.0	Unk vs Bkgd	3.70(0.52,26.5)	0.194
Low	148	1	6.8	Low vs Bkgd	2.76(0.25,30.6)	0.409
High	195	1	5.1	High vs Bkgd	2.09(0.19,23.2)	0.549
Total	1376					

Table 6-36 (Continued)

b) Adjusted

Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	715	No adjusted analyses, only 6 defects total			
Unknown	199				
Low	137				
High	180				
Total	1231				

Digestive System Anomalies (All Children)

Model 1: Children of Ranch Hands - \log_2 (Initial Dioxin)

Without adjustment for covariates (Table 6-37 [a] and [b]), there is no significant association between digestive system anomalies and initial dioxin among children of Ranch Hands having more than 10 ppt ($p=0.744$) or more than 5 ppt ($p=0.977$) current dioxin.

After adjustment for covariates (Table 6-37 [c] and [d]), there is no significant association between digestive system anomalies and initial dioxin among children of Ranch Hands having more than 10 ppt ($p=0.799$) or more than 5 ppt ($p=0.884$) current dioxin.

Table 6-37

**Post-SEA Counts and Rates of
Digestive System Anomalies**

Variable: Digestive System Anomalies
 Restrictions: All Children of Ranch Hands
 Children Conceived during or after the
 Father's Duty in SEA
 Model 1: $\text{Log}_2(\text{Initial Dioxin})$

Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$ - Unadjusted

Exposure Restriction	Initial Dioxin	n	Abnormal Number	Rate	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=508)	Low	106	2	18.9	0.92(0.56,1.51)	0.744
	Medium	245	6	24.5		
	High	157	4	25.5		
b) D>5 ppt (n=690)	Low	155	3	19.4	1.01(0.71,1.43)	0.977
	Medium	308	8	26.0		
	High	227	5	22.0		

Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$ - Adjusted

Exposure Restriction	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=458)	0.94(0.56,1.56)	0.799	None
d) D>5 ppt (n=616)	1.03(0.71,1.49)	0.884	None

Digestive System Anomalies (All Children)

Model 2: Children of Ranch Hands - $\text{Log}_2(\text{Current Dioxin})$ and Time

Without adjustment for covariates (Table 6-38 [a]), there is no significant variation in the association between anomalies of the digestive system and current dioxin level with time since duty in SEA among children of Ranch Hands having more than 10 ppt current dioxin ($p=0.567$). Furthermore, there is no significant association between digestive system anomalies and current dioxin among children of Ranch Hands with late ($p=0.859$) or early ($p=0.482$) tours.

Without adjustment for covariates (Table 6-38 [b]), there is no significant variation in the association between anomalies of the digestive system and current dioxin with time since duty in SEA among children of Ranch Hands having more than 5 ppt current dioxin ($p=0.682$). Furthermore, there is no significant association between digestive system anomalies and current dioxin among children of Ranch Hands with late ($p=0.745$) or early ($p=0.802$) tours.

After adjustment for covariates (Table 6-38 [c]), there is no significant variation in the association between anomalies of the digestive system and current dioxin with time since duty in SEA among children of Ranch Hands having more than 5 ppt current dioxin ($p=0.678$). Furthermore, there is no significant association between digestive system anomalies and current dioxin among children of Ranch Hands with late ($p=0.898$) or early ($p=0.620$) tours.

After adjustment for covariates (Table 6-38 [d]), there is no significant variation in the association between anomalies of the digestive system and current dioxin with time since duty in SEA among children of Ranch Hands having more than 5 ppt current dioxin ($p=0.890$). Furthermore, there is no significant association between digestive system anomalies and current dioxin among children of Ranch Hands with late ($p=0.793$) or early ($p=0.933$) tours.

Table 6-38

**Post-SEA Counts and Rates of
Digestive System Anomalies**

Variable: Digestive System Anomalies
 Restrictions: All Children of Ranch Hands
 Children Conceived during or after the
 Father's Duty in SEA
 Model 2: $\text{Log}_2(\text{Current Dioxin}), \text{Time}$

Ranch Hands - $\text{Log}_2(\text{Current Dioxin}), \text{Time}$ - Unadjusted						
Exposure Restriction	Time Since SEA (years)	Anomaly Rate (No./n)			Est. Relative Risk (95% C.I.)	p-Value
		Low	Medium	High		
a) D>10 ppt (n=509)						0.567
	≤18.6	16.1 (1/62)	14.9 (2/134)	27.8 (2/72)	1.08(0.47, 2.48)	0.859
	>18.6	25.0 (1/40)	37.0 (4/108)	21.5 (2/93)	0.79(0.41, 1.52)	0.482
b) D>5 ppt (n=690)						0.682
	≤18.6	11.1 (1/90)	23.0 (4/174)	18.2 (2/110)	1.10(0.62, 1.94)	0.745
	>18.6	0.0 (0/63)	51.5 (7/136)	17.1 (2/117)	0.94(0.60, 1.49)	0.802

Table 6-38 (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=459)			0.678	None
	≤18.6	1.05(0.46,2.40)	0.898	
	>18.6	0.84(0.43,1.66)	0.620	
d) D>5 ppt (n=616)			0.890	None
	≤18.6	1.08(0.61,1.90)	0.793	
	>18.6	1.02(0.62,1.69)	0.933	

Digestive System Anomalies (All Children)

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

Without adjustment for covariates (Table 6-39 [a]), there is no significant overall association between anomalies of the digestive system and categorized current dioxin ($p=0.740$). Furthermore, the rates of digestive system anomalies among children of Ranch Hands in the High ($p=0.539$), Low ($p=0.446$) and Unknown ($p=0.757$) categories are not significantly different from the rate among children of Comparisons in the Background category.

After adjustment for covariates (Table 6-39 [b]), there is no significant overall association between anomalies of the digestive system and categorized current dioxin ($p=0.734$). Furthermore, the rates of digestive system anomalies among children of Ranch Hands in the High ($p=0.421$), Low ($p=0.609$) and Unknown ($p=0.709$) categories are not significantly different from the rate among children of Comparisons in the Background category.

Table 6-39

**Post-SEA Counts and Rates of
Digestive System Anomalies**

Variable: Digestive System Anomalies
 Restrictions: All Children of Ranch Hands and Comparisons
 Children Conceived during or after the
 Father's Duty in SEA
 Model 3: Categorized Current Dioxin

a) Unadjusted

Exposure Category	n	Abnormal Number	Rate	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	981	24	24.5	All Exp Categ		0.740
Unknown	282	6	21.3	Unk vs Bkgd	0.87(0.35,2.14)	0.757
Low	174	6	34.5	Low vs Bkgd	1.42(0.57,3.54)	0.446
High	227	4	17.6	High vs Bkgd	0.72(0.25,2.08)	0.539
Total	1664					

b) Adjusted

Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	843	All Exp Categ		0.734	OCC(p=0.008)
Unknown	246	Unk vs Bkgd	0.83(0.31,2.23)	0.709	
Low	156	Low vs Bkgd	1.30(0.48,3.51)	0.609	
High	203	High vs Bkgd	0.64(0.21,1.91)	0.421	
Total	1448				

Digestive System Anomalies (Full Siblings)**Model 1: Children of Ranch Hands - Log₂(Initial Dioxin)**

Without adjustment for covariates (Table 6-40 [a] and [b]), there is no significant association between anomalies of the digestive system and initial dioxin among full sibling children of Ranch Hands having more than 10 ppt (p=0.588) or more than 5 ppt (p=0.930) current dioxin.

After adjustment for covariates (Table 6-40 [c] and [d]), there is no significant association between anomalies of the digestive system and initial dioxin among full sibling children of Ranch Hands having more than 10 ppt ($p=0.620$) or more than 5 ppt ($p=0.984$) current dioxin.

Table 6-40

Post-SEA Counts and Rates of
Digestive System Anomalies

Variable: Digestive System Anomalies
Restrictions: Full Siblings of Ranch Hands
Children Conceived during or after the
Father's Duty in SEA
Model 1: $\text{Log}_2(\text{Initial Dioxin})$

Ranch Hands - Log ₂ (Initial Dioxin) - Unadjusted						
Exposure Restriction	Initial Dioxin	n	Abnormal Number	Rate	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=420)	Low	78	1	12.8	0.86(0.49,1.50)	0.588
	Medium	206	6	29.1		
	High	136	3	22.1		
b) D>5 ppt (n=557)	Low	114	2	17.5	1.02(0.68,1.53)	0.930
	Medium	245	6	24.5		
	High	198	4	20.2		
Ranch Hands - Log ₂ (Initial Dioxin) - Adjusted						
Exposure Restriction	Adj. Relative Risk (95% C.I.)		p-Value		Covariate Remarks	
c) D>10 ppt (n=390)	0.86(0.46,1.59)		0.620		M-AGE(p=0.024) F-AGE(p=0.034) C-TIME(p=0.103)	
d) D>5 ppt (n=513)	1.01(0.66,1.53)		0.984		None	

Digestive System Anomalies (Full Siblings)

Model 2: Children of Ranch Hands - \log_2 (Current Dioxin) and Time

Without adjustment for covariates (Table 6-41 [a]), there is no significant variation in the association between digestive system anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands having more than 10 ppt current dioxin ($p=0.532$). Furthermore, there is no significant association between digestive system anomalies and current dioxin among children of Ranch Hands with late ($p=0.937$) or early ($p=0.418$) tours.

Without adjustment for covariates (Table 6-41 [b]), there is no significant variation in the association between digestive system anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands having more than 5 ppt current dioxin ($p=0.616$). Furthermore, there is no significant association between digestive system anomalies and current dioxin among children of Ranch Hands with late ($p=0.623$) or early ($p=0.840$) tours.

After adjustment for covariates (Table 6-41 [c]), there is no significant variation in the association between digestive system anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands having more than 10 ppt current dioxin ($p=0.549$). Furthermore, there is no significant association between digestive system anomalies and current dioxin among children of Ranch Hands with late ($p=0.917$) or early ($p=0.505$) tours.

After adjustment for covariates (Table 6-41 [d]), there is no significant variation in the association between digestive system anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands having more than 5 ppt current dioxin ($p=0.649$). Furthermore, there is no significant association between digestive system anomalies and current dioxin among children of Ranch Hands with late ($p=0.666$) or early ($p=0.836$) tours.

Table 6-41

**Post-SEA Counts and Rates of
Digestive System Anomalies**

Variable: Digestive System Anomalies
 Restrictions: Full Siblings of Ranch Hands
 Children Conceived 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)	Anomaly Rate (No./n) Current Dioxin			Est. Relative Risk (95% C.I.)	p-Value
		Low	Medium	High		
a) D>10 ppt (n=421)						0.532
	≤18.6	21.3 (1/47)	17.4 (2/115)	31.3 (2/64)	1.03(0.45,2.39)	0.937
	>18.6	0.0 (0/28)	43.5 (4/92)	13.3 (1/75)	0.71(0.31,1.62)	0.418
b) D>5 ppt (n=557)						0.616
	≤18.6	0.0 (0/59)	27.8 (4/144)	20.4 (2/98)	1.17(0.63,2.16)	0.623
	>18.6	0.0 (0/53)	47.2 (5/106)	10.3 (1/97)	0.94(0.54,1.64)	0.840

Table 6-41 (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=391)			0.549	M-AGE(p=0.021)
				F-AGE(p=0.032)
				C-TIME(p=0.088)
	≤18.6	1.05(0.44,2.48)	0.917	
	>18.6	0.71(0.26,1.93)	0.505	
d) D>5 ppt (n=513)			0.649	None
	≤18.6	1.14(0.62,2.12)	0.666	
	>18.6	0.94(0.51,1.71)	0.836	

Digestive System Anomalies (Full Siblings)

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

Without adjustment for covariates (Table 6-42 [a]), there is no significant overall association between anomalies of the digestive system and categorized current dioxin among full siblings (p=0.447). Furthermore, there is no significant difference between the rates of digestive system anomalies among children of Ranch Hands in the High (p=0.691), Low (p=0.129) and Unknown (p=0.878) categories and the rate among children of Comparisons in the Background category.

After adjustment for covariates (Table 6-42 [b]), there is no significant overall association between anomalies of the digestive system and categorized current dioxin among full siblings (p=0.542). Furthermore, there is no significant difference between the rates of digestive system anomalies among children of Ranch Hands in the High (p=0.694), Low (p=0.171) and Unknown (p=0.890) categories and the rate among children of Comparisons in the Background category.

Table 6-42

**Post-SEA Counts and Rates of
Digestive System Anomalies**

Variable: Digestive System Anomalies
 Restrictions: Full Siblings of Ranch Hands and Comparisons
 Children Conceived during or after the
 Father's Duty in SEA
 Model 3: Categorized Current Dioxin

a) Unadjusted

Exposure Category	n	Abnormal Number	Rate	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	812	16	19.7	All Exp Categ		0.447
Unknown	221	4	18.1	Unk vs Bkgd	0.92(0.30,2.77)	0.878
Low	148	6	40.5	Low vs Bkgd	2.10(0.81,5.47)	0.129
High	195	3	15.4	High vs Bkgd	0.78(0.22,2.70)	0.691
Total	1376					

b) Adjusted

Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	715	All Exp Categ		0.542	RACE(p=0.060)
Unknown	199	Unk vs Bkgd	1.08(0.35,3.39)	0.890	OCC(p=0.041)
Low	137	Low vs Bkgd	2.08(0.73,5.97)	0.171	
High	180	High vs Bkgd	0.77(0.21,2.81)	0.694	
Total	1231				

Genital Anomalies (All Children)**Model 1: Children of Ranch Hands - Log₂(Initial Dioxin)**

Without adjustment for covariates (Table 6-43 [a] and [b]), there is no significant association between genital anomalies and initial dioxin among children of Ranch Hands having more than 10 ppt (p=0.346) or more than 5 ppt (p=0.971) current dioxin.

After adjustment for covariates (Table 6-43 [c] and [d]), the association between genital anomalies and initial dioxin is not significant among children of Ranch Hands having more than 10 ppt ($p=0.215$) or having more than 5 ppt ($p=1.000$).

Table 6-43

Post-SEA Counts and Rates of
Genital Anomalies

Variable: Genital Anomalies
Restrictions: All Children of Ranch Hands
Children Conceived during or after the
Father's Duty in SEA
Model 1: $\text{Log}_2(\text{Initial Dioxin})$

Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$ - Unadjusted						
Exposure Restriction	Initial Dioxin	n	Abnormal Number	Rate	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=508)	Low	106	1	9.4	0.79(0.48,1.31)	0.346
	Medium	245	10	40.8		
	High	157	2	12.7		
b) D>5 ppt (n=690)	Low	155	2	12.9	1.01(0.70,1.45)	0.971
	Medium	308	11	35.7		
	High	227	2	8.8		

Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$ - Adjusted

Exposure Restriction	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=458)	0.72(0.42,1.23)	0.215	OCC($p=0.028$)
d) D>5 ppt (n=616)	1.00(0.70,1.43)	1.000	None

Genital Anomalies (All Children)

Model 2: Children of Ranch Hands - \log_2 (Current Dioxin) and Time

Without adjustment for covariates (Table 6-44 [a]), there is no significant variation in the association between genital anomalies and current dioxin with time since duty in SEA among children of Ranch Hands having more than 10 ppt current dioxin ($p=0.883$). Furthermore, there is no association between genital anomalies and current dioxin among children of Ranch Hands with late ($p=0.498$) or early ($p=0.739$) tours.

Without adjustment for covariates (Table 6-44 [b]), there is no significant variation in the association between genital anomalies and current dioxin with time since duty in SEA among children of Ranch Hands having more than 5 ppt current dioxin ($p=0.916$). Furthermore, there is no association between genital anomalies and current dioxin among children of Ranch Hands with late ($p=0.613$) or early ($p=0.630$) tours.

After adjustment for covariates (Table 6-44 [c]), there is no significant variation in the association between genital anomalies and current dioxin with time since duty in SEA among children of Ranch Hands having more than 10 ppt current dioxin ($p=0.822$). Furthermore, there is no association between genital anomalies and current dioxin among children of Ranch Hands with late ($p=0.465$) or early ($p=0.777$) tours.

After adjustment for covariates (Table 6-44 [d]), there is no significant variation in the association between genital anomalies and current dioxin with time since duty in SEA among children of Ranch Hands having more than 5 ppt current dioxin ($p=0.881$). Furthermore, there is no association between genital anomalies and current dioxin among children of Ranch Hands with late ($p=0.669$) or early ($p=0.632$) tours.

Table 6-44

**Post-SEA Counts and Rates of
Genital Anomalies**

Variable: Genital Anomalies
 Restrictions: All Children of Ranch Hands
 Children Conceived during or after the
 Father's Duty in SEA
 Model 2: $\text{Log}_2(\text{Current Dioxin}), \text{Time}$

Ranch Hands - $\text{Log}_2(\text{Current Dioxin}), \text{Time}$ - Unadjusted

Exposure Restriction	Time Since SEA (years)	Anomaly Rate (No./n)			Est. Relative Risk (95% C.I.)	p-Value
		Low	Medium	High		
a) D>10 ppt (n=509)						0.883
	≤18.6	16.1 (1/62)	59.7 (8/134)	13.9 (1/72)	0.80(0.42,1.53)	0.498
	>18.6	0.0 (0/40)	27.8 (3/108)	10.8 (1/93)	0.87(0.38,2.00)	0.739
b) D>5 ppt (n=690)						0.916
	≤18.6	11.1 (1/90)	46.0 (8/174)	18.2 (2/110)	1.12(0.71,1.77)	0.613
	>18.6	0.0 (0/63)	22.1 (3/136)	8.5 (1/117)	1.17(0.61,2.25)	0.630

Table 6-44 (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=459)			0.822	None
	≤18.6	0.79(0.42,1.49)	0.465	
	>18.6	0.89(0.39,2.01)	0.777	
d) D>5 ppt (n=616)			0.881	None
	≤18.6	1.10(0.70,1.73)	0.669	
	>18.6	1.17(0.61,2.24)	0.632	

Genital Anomalies (All Children)

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

Without adjustment for covariates (Table 6-45 [a]), there is a significant overall association between genital anomalies and categorized dioxin ($p=0.005$). Additionally, the genital anomaly rate among children of Ranch Hands in the Low current dioxin category is significantly greater than the rate among children of Comparisons in the Background category ($OR=2.92$, 95% CI 1.29-6.61, $p=0.010$). Corresponding contrasts between children of Ranch Hands in the High ($p=0.595$) and Unknown categories ($p=0.107$) with children of Comparisons in the Background category are not significant.

After adjustment for covariates (Table 6-45 [b]), there is a significant overall association between genital anomalies and categorized dioxin ($p=0.007$). Additionally, the genital anomaly rate among children of Ranch Hands in the Low current dioxin category is significantly greater than the rate among children of Comparisons in the Background category ($OR=2.89$, 95% CI 1.26-6.64, $p=0.012$). Corresponding contrasts between children of Ranch Hands in the High ($p=0.724$) and Unknown categories ($p=0.112$) with children of Comparisons in the Background category are not significant.

Table 6-45

**Post-SEA Counts and Rates of
Genital Anomalies**

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

a) Unadjusted

Exposure Category	n	Abnormal Number	Rate	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	981	18	18.3	All Exp Categ		0.005
Unknown	282	1	3.5	Unk vs Bkgd	0.19(0.03,1.43)	0.107
Low	174	9	51.7	Low vs Bkgd	2.92(1.29,6.61)	0.010
High	227	3	13.2	High vs Bkgd	0.72(0.21,2.46)	0.595
Total	1664					

b) Adjusted

Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	843	All Exp Categ		0.007	SMOKE(p=0.046)
Unknown	246	Unk vs Bkgd	0.19(0.03,1.46)	0.112	
Low	156	Low vs Bkgd	2.89(1.26,6.64)	0.012	
High	203	High vs Bkgd	0.80(0.23,2.77)	0.724	
Total	1448				

Genital Anomalies (Full Siblings)**Model 1: Children of Ranch Hands - Log₂(Initial Dioxin)**

Without adjustment for covariates (Table 6-46 [a] and [b]), there is no significant association between genital anomalies and initial dioxin among full sibling children of Ranch Hands having more than 10 ppt (p=0.427) or more than 5 ppt (p=0.757) current dioxin.

After adjustment for covariates (Table 6-46 [c] and [d]), there is no significant association between genital anomalies and initial dioxin among full sibling children of Ranch Hands having more than 10 ppt ($p=0.422$) or more than 5 ppt ($p=0.938$).

Table 6-46

Post-SEA Counts and Rates of
Genital Anomalies

Variable: Genital Anomalies
Restrictions: Full Siblings of Ranch Hands
Children Conceived 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	Abnormal Number	Rate	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=420)	Low	78	1	12.8	0.79(0.43,1.44)	0.427
	Medium	206	6	29.1		
	High	136	2	14.7		
b) D>5 ppt (n=557)	Low	114	2	17.5	0.93(0.61,1.44)	0.757
	Medium	245	7	28.6		
	High	198	2	10.1		
Ranch Hands - Log ₂ (Initial Dioxin) - Adjusted						
Exposure Restriction	Adj. Relative Risk (95% C.I.)		p-Value		Covariate Remarks	
c) D>10 ppt (n=390)	0.79(0.43,1.44)		0.422		None	
d) D>5 ppt (n=513)	0.98(0.64,1.52)		0.938		None	

Genital Anomalies (Full Siblings)

Model 2: Children of Ranch Hands - \log_2 (Current Dioxin) and Time

Without adjustment for covariates (Table 6-47 [a]), there is no significant variation in the association between genital anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands having more than 10 ppt current dioxin ($p=0.372$). Furthermore, there is no significant association between genital anomalies and current dioxin among children of Ranch Hands with late ($p=0.308$) or early ($p=0.695$) tours.

Without adjustment for covariates (Table 6-47 [b]), there is no significant variation in the association between genital anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands having more than 5 ppt current dioxin ($p=0.420$). Furthermore, there is no significant association between genital anomalies and current dioxin among children of Ranch Hands with late ($p=0.900$) or early ($p=0.397$) tours.

After adjustment for covariates (Table 6-47 [c]), there is significant variation in the association between genital anomalies and current dioxin with time since duty in SEA and the father's age at the time of conception among full sibling children of Ranch Hands having more than 10 ppt current dioxin ($p=0.030$). The basis for this variation in risk is displayed in Appendix D-2. For neither the younger fathers (less than 30 years) or the older fathers (30 or older) is there a significant association between the genital anomalies and current dioxin in the children of Ranch Hands with late tours ($p=0.934$ and $p=0.349$, respectively). There is insufficient data for similar comparisons among children of Ranch Hands with early tours. When this variation in risk is ignored, there is no significant variation association between genital anomalies and current dioxin with time since duty in SEA ($p=0.359$). Furthermore, the association between genital anomalies and current dioxin is not significant among children whose father had a late ($p=0.289$) or early ($p=0.699$) tour.

After adjustment for covariates (Table 6-47 [d]), there is no significant variation in the association between genital anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands having more than 5 ppt current dioxin ($p=0.409$). Furthermore, there is no significant association between genital anomalies and current dioxin among children of Ranch Hands with late ($p=0.844$) or early ($p=0.404$) tours.

Table 6-47

**Post-SEA Counts and Rates of
Genital Anomalies**

Variable: Genital Anomalies
 Restrictions: Full Siblings of Ranch Hands
 Children Conceived during or after the
 Father's Duty in SEA
 Model 2: $\log_2(\text{Current Dioxin}), \text{Time}$

Ranch Hands - $\log_2(\text{Current Dioxin}), \text{Time}$ - Unadjusted						
Exposure Restriction	Time Since SEA (years)	Anomaly Rate (No./n)			Est. Relative Risk (95% C.I.)	p-Value
		Low	Medium	High		
a) D>10 ppt (n=421)						0.372
	≤18.6	21.3 (1/47)	52.2 (6/115)	15.6 (1/64)	0.68(0.32,1.44)	0.308
	>18.6	0.0 (0/28)	10.9 (1/92)	13.3 (1/75)	1.24(0.42,3.71)	0.695
b) D>5 ppt (n=557)						0.420
	≤18.6	16.9 (1/59)	48.6 (7/144)	10.2 (1/98)	0.97(0.57,1.63)	0.900
	>18.6	0.0 (0/53)	9.4 (1/106)	10.3 (1/97)	1.49(0.59,3.73)	0.397

Table 6-47 (Continued)

Ranch Hands - Log₂(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=391)			0.359***	F-AGE*TIME* DIOXIN(p=0.030)
	≤18.6	0.66(0.31,1.42)***	0.289***	
	>18.6	1.23(0.42,3.59)***	0.699***	
d) D>5 ppt (n=513)			0.409	None
	≤18.6	0.95(0.56,1.60)	0.844	
	>18.6	1.47(0.59,3.63)	0.404	

Genital Anomalies (Full Siblings)

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

Without adjustment for covariates (Table 6-48 [a]), there is a significant overall association between genital anomalies and categorized dioxin among full siblings (p=0.028). The genital anomaly rate among children of Ranch Hands in the Low category is significantly greater than the rate among children of Comparisons in the Background category (p=0.050). However, the same contrast was not significant for the High (p=0.380) and Unknown (p=0.150) categories.

After adjustment for covariates (Table 6-48 [b]), there is a significant overall association between genital anomalies and categorized dioxin among full siblings (p=0.027). The genital anomaly rate among children of Ranch Hands in the Low category is borderline significantly greater than the rate among children of Comparisons in the Background category (p=0.075). However, the rates among children of Ranch Hands in the High (p=0.298) and Unknown (p=0.136) categories are not significantly different from the rate among children of Comparisons in the Background category.

Table 6-48

**Post-SEA Counts and Rates of
Genital Anomalies**

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

a) Unadjusted

Exposure Category	n	Abnormal Number	Rate	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	812	16	19.7	All Exp Categ		0.028
Unknown	221	1	4.5	Unk vs Bkgd	0.23(0.03,1.72)	0.150
Low	148	7	47.3	Low vs Bkgd	2.47(1.00,6.12)	0.050
High	195	2	10.3	High vs Bkgd	0.52(0.12,2.26)	0.380
Total	1376					

b) Adjusted

Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	715	All Exp Categ		0.027	DRINK(p=0.044)
Unknown	199	Unk vs Bkgd	0.22(0.03,1.63)	0.136	
Low	137	Low vs Bkgd	2.28(0.92,5.67)	0.075	
High	180	High vs Bkgd	0.46(0.10,2.01)	0.298	
Total	1231				

Urinary System Anomalies (All Children)**Model 1: Children of Ranch Hands - Log₂(Initial Dioxin)**

Without adjustment for covariates (Table 6-49 [a] and [b]), there is no significant association between urinary system anomalies and initial dioxin among children of Ranch Hands having more than 10 ppt (p=0.944) or more than 5 ppt (p=0.444) current dioxin.

There is insufficient data with which to assess the significance of the association between urinary system anomalies and initial dioxin with adjustment for covariates (Table 6-49 [c] and [d]).

Table 6-49

Post-SEA Counts and Rates of
Urinary System Anomalies

Variable: Urinary System Anomalies
Restrictions: All Children of Ranch Hands
Children Conceived during or after the
Fathers Duty in SEA
Model 1: $\text{Log}_2(\text{Initial Dioxin})$

Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$ - Unadjusted						
Exposure Restriction	Initial Dioxin	n	Abnormal Number	Rate	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=508)	Low	106	3	28.3	0.98(0.62,1.57)	0.944
	Medium	245	6	24.5		
	High	157	4	25.5		
b) D>5 ppt (n=690)	Low	155	2	12.9	1.15(0.81,1.63)	0.444
	Medium	308	7	22.7		
	High	227	6	26.4		

Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$ - Adjusted

Exposure Restriction	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=458)	No adjusted analyses, only 13 defects total		
d) D>5 ppt (n=616)	No adjusted analyses, only 15 defects total		

Urinary System Anomalies (All Children)

Model 2: Children of Ranch Hands - $\text{Log}_2(\text{Current Dioxin})$ and Time

Without adjustment for covariates (Table 6-50 [a]), there is no significant variation in the association between urinary system anomalies and current dioxin with time since duty in SEA among children of Ranch Hands having more than 10 ppt current dioxin ($p=0.957$). Furthermore, there is no significant association between urinary system anomalies and current dioxin level among children of Ranch Hands with late ($p=0.913$) or early ($p=0.798$) tours.

Without adjustment for covariates (Table 6-50 [b]), there is no significant variation in the association between urinary system anomalies and current dioxin with time since duty in SEA among children of Ranch Hands having more than 5 ppt current dioxin ($p=0.623$). Furthermore, there is no significant association between urinary system anomalies and current dioxin among children of Ranch Hands with late ($p=0.946$) or early ($p=0.387$) tours.

There is insufficient data to assess the significance of variation in the association between urinary system anomalies and current dioxin with time since duty in SEA with adjustment for covariates (Table 6-50 [c] and [d]).

Table 6-50

**Post-SEA Counts and Rates of
Urinary System Anomalies**

Variable: Urinary System Anomalies
 Restrictions: All Children of Ranch Hands
 Children Conceived during or after the
 Father's Duty in SEA
 Model 2: $\text{Log}_2(\text{Current Dioxin}), \text{Time}$

Ranch Hands - $\text{Log}_2(\text{Current Dioxin}), \text{Time}$ - Unadjusted

Exposure Restriction	Time Since SEA (years)	Anomaly Rate (No./n) Current Dioxin			Est. Relative Risk (95% C.I.)	p-Value
		Low	Medium	High		
a) D>10 ppt (n=509)						0.957
	≤18.6	16.1 (1/62)	22.4 (3/134)	13.9 (1/72)	0.95(0.40,2.25)	0.913
	>18.6	25.0 (1/40)	37.0 (4/108)	32.3 (3/93)	0.93(0.52,1.66)	0.798
b) D>5 ppt (n=690)						0.623
	≤18.6	22.2 (2/90)	17.2 (3/174)	18.2 (2/110)	1.02(0.57,1.82)	0.946
	>18.6	0.0 (0/63)	36.8 (5/136)	25.6 (3/117)	1.23(0.77,1.95)	0.387

Ranch Hands - $\text{Log}_2(\text{Current Dioxin}), \text{Time}$ - Adjusted

Exposure Restriction	Time Since SEA (years)	Adj. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
c) D>10 ppt (n=459)		No adjusted analyses, only 13 defects total		
d) D>5 ppt (n=616)		No adjusted analyses, only 15 defects total		

Urinary System Anomalies (All Children)

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

Without adjustment for covariates (Table 6-51 [a]), there is no significant overall association between urinary system anomalies and categorized dioxin ($p=0.228$). However, the rate of urinary system anomalies among children of Ranch Hands in the Low category is significantly greater than the rate among children of Comparisons in the Background category ($p=0.037$). The rates of urinary system anomalies among children of Ranch Hands in the High ($p=0.267$) and Unknown ($p=0.796$) categories are not significantly different from the rate among children of Comparisons in the Background category.

After adjustment for covariates (Table 6-51 [b]), there is no significant overall association between urinary system anomalies and categorized dioxin ($p=0.170$). However, the rate of urinary system anomalies among children of Ranch Hands in the Low ($p=0.021$) category is significantly greater than the rate among children of Comparisons in the Background category. The rates of urinary system anomalies among children of Ranch Hands in the High ($p=0.388$) and Unknown ($p=0.966$) categories do not differ significantly from the rate among children of Comparisons in the Background category.

Table 6-51

Post-SEA Counts and Rates of Urinary System Anomalies

Variable: Urinary System Anomalies
Restrictions: All Children of Ranch Hands and Comparisons
Children Conceived during or after the
Father's Duty in SEA
Model 3: Categorized Current Dioxin

a) Unadjusted

Exposure Category	n	Abnormal Number	Rate	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	981	12	12.2	All Exp Categ		0.228
Unknown	282	4	14.2	Unk vs Bkgd	1.16(0.37, 3.63)	0.796
Low	174	6	34.5	Low vs Bkgd	2.88(1.07, 7.79)	0.037
High	227	5	22.0	High vs Bkgd	1.82(0.63, 5.22)	0.267
Total	1664					

Table 6-51 (Continued)

b) Adjusted

Exposure Category		Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	843	All Exp Categ		0.170	DRINK(p=0.065)
Unknown	246	Unk vs Bkgd	1.03(0.28,3.77)	0.966	
Low	156	Low vs Bkgd	3.33(1.19,9.31)	0.021	
High	203	High vs Bkgd	1.67(0.52,5.40)	0.388	
Total	1448				

Urinary System Anomalies (Full Siblings)

Model 1: Children of Ranch Hands - $\text{Log}_2(\text{Initial Dioxin})$

Without adjustment for covariates (Table 6-52 [a] and [b]), there is no significant association between urinary system anomalies and initial dioxin among full sibling children of Ranch Hands having more than 10 ppt (p=0.877) or more than 5 ppt (p=0.668) current dioxin.

There is insufficient data with which to assess the association between urinary system anomalies and initial dioxin among full sibling children of Ranch Hands with adjustment for covariates (Table 6-52 [c] and [d]).

Table 6-52

**Post-SEA Counts and Rates of
Urinary System Anomalies**

Variable: Urinary System Anomalies
 Restrictions: Full Siblings of Ranch Hands
 Children Conceived during or after the
 Father's Duty in SEA
 Model 1: $\text{Log}_2(\text{Initial Dioxin})$

Ranch Hands - Log ₂ (Initial Dioxin) - Unadjusted						
Exposure Restriction	Initial Dioxin	n	Abnormal Number	Rate	Est. Relative Risk (95% C.I.)	p-Value
a) D>10 ppt (n=420)	Low	78	2	25.6	0.96(0.57,1.61)	0.877
	Medium	206	6	29.1		
	High	136	3	22.1		
b) D>5 ppt (n=557)	Low	114	2	17.5	1.09(0.74,1.60)	0.668
	Medium	245	6	24.5		
	High	198	5	25.3		
Ranch Hands - Log ₂ (Initial Dioxin) - Adjusted						
Exposure Restriction	Adj. Relative Risk (95% C.I.)				p-Value	Covariate Remarks
c) D>10 ppt (n=390)	No adjusted analyses, only 11 defects total					
d) D>5 ppt (n=513)	No adjusted analyses, only 13 defects total					

Urinary System Anomalies (Full Siblings)

Model 2: Children of Ranch Hands - $\text{Log}_2(\text{Current Dioxin})$ and Time

Without adjustment for covariates (Table 6-53 [a]), there is no significant variation in the association between urinary system anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands having more than 10 ppt current dioxin ($p=0.607$). Furthermore, there is no significant association between urinary system anomalies and current dioxin among children of Ranch Hands with late ($p=0.852$) or early ($p=0.530$) tours.

Without adjustment for covariates (Table 6-53 [b]), there is no significant variation in the association between urinary system anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands having more than 5 ppt current dioxin ($p=0.712$). Furthermore, there is no significant association between urinary system anomalies and current dioxin among children of Ranch Hands with late ($p=0.949$) or early ($p=0.606$) tours.

There is insufficient data with which to assess the significance of the variation in the association between urinary system anomalies and current dioxin with time since duty in SEA among full sibling children of Ranch Hands with adjustment for covariates (Table 6-53 [c] and [d]).

Table 6-53

Post-SEA Counts and Rates of
Urinary System Anomalies

Variable: Urinary System Anomalies
Restrictions: Full Siblings of Ranch Hands
Children Conceived during or after the
Father's Duty in SEA
Model 2: $\log_2(\text{Current Dioxin})$, Time

Ranch Hands - $\log_2(\text{Current Dioxin})$, Time - Unadjusted						
Exposure Restriction	Time Since SEA (years)	Anomaly Rate (No./n)			Est. Relative Risk (95% C.I.)	p-Value
		Low	Medium	High		
a) D>10 ppt (n=421)						0.607
	≤18.6	21.3 (1/47)	17.4 (2/115)	15.6 (1/64)	1.09(0.43,2.75)	0.852
	>18.6	35.7 (1/28)	43.5 (4/92)	26.7 (2/75)	0.81(0.42,1.57)	0.530
b) D>5 ppt (n=557)						0.712
	≤18.6	33.9 (2/59)	13.9 (2/144)	20.4 (2/98)	0.98(0.52,1.85)	0.949
	>18.6	0.0 (0/53)	47.2 (5/106)	20.6 (2/97)	1.14(0.69,1.87)	0.606

Table 6-53 (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=391)		No adjusted analyses, only 11 defects total		
d) D>5 ppt (n=513)		No adjusted analyses, only 13 defects total		

Urinary System Anomalies (Full Siblings)

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

Without adjustment for covariates (Table 6-54 [a]), there is no significant overall association between urinary system anomalies and categorized dioxin among full siblings ($p=0.440$). However, the rate of urinary system anomalies among children of Ranch Hands in the Low category is borderline significantly greater than the rate among children of Comparisons in the Background category ($p=0.087$). The rates of urinary system anomalies among children of Ranch Hands in the High ($p=0.474$) and Unknown ($p=0.617$) categories do not differ significantly from the rate among children of Comparisons in the Background category.

After adjustment for covariates (Table 6-54 [b]), there is no significant overall association between urinary system anomalies and categorized dioxin among full siblings ($p=0.352$). However, the rate of urinary system anomalies among children of Ranch Hands in the Low category is significantly greater than the rate among children of Comparisons in the Background category ($p=0.055$). The rates of urinary system anomalies among the children of Ranch Hands in the High ($p=0.672$) and Unknown ($p=0.786$) categories are not significantly different from the rate among children of Comparisons in the Background category.

Table 6-54

**Post-SEA Counts and Rates of
Urinary System Anomalies**

Variable: Urinary System Anomalies
 Restrictions: Full Siblings of Ranch Hands and Comparisons
 Children Conceived during or after the
 Father's Duty in SEA
 Model 3: Categorized Current Dioxin

a) Unadjusted

Exposure Category	n	Abnormal Number	Rate	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value
Background	812	11	13.5	All Exp Categ		0.440
Unknown	221	4	18.1	Unk vs Bkgd	1.34(0.42,4.26)	0.617
Low	148	5	33.8	Low vs Bkgd	2.55(0.87,7.44)	0.087
High	195	4	20.5	High vs Bkgd	1.52(0.48,4.85)	0.474
Total	1376					

b) Adjusted

Exposure Category	n	Category Contrast	Est. Relative Risk (95% C.I.)	p-Value	Covariate Remarks
Background	715	All Exp Categ		0.352	DRINK(p=0.093)
Unknown	199	Unk vs Bkgd	1.20(0.32,4.48)	0.786	
Low	137	Low vs Bkgd	2.97(0.98,9.02)	0.055	
High	180	High vs Bkgd	1.33(0.36,4.97)	0.672	
Total	1231				

Musculoskeletal Deformities (All Children)**Model 1: Children of Ranch Hands - Log₂(Initial Dioxin)**

Without adjustment for covariates (Table 6-55 [a] and [b]), there is no association between musculoskeletal deformities and initial dioxin among children of Ranch Hands having more than 10 ppt (p=0.154) or more than 5 ppt (p=0.365) current dioxin.