

## Memorandum

1 March 2012

**From:** David Bussard  
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U.S. Environmental Protection Agency

**To:** Diana Wong, Ph.D.  
Designated Federal Officer  
Science Advisory Board  
U.S. EPA

**Subject:** Data request from the SAB for the external review draft Toxicological Review of Libby Amphibole

Our memorandum (6 Feb 2012) provided additional information on the exposure-response modeling presented in chapter 5 and Appendix E of the External Review Draft of the Toxicological Review of Libby Amphibole Asbestos currently under review, in response to your request [e-mail, 3 Feb 2012, 4:25 PM]. As noted in that memo, we did not provide a response to the third request for additional model results for the full cohort at the time. These model parameters, and benchmark concentrations for the full cohort were calculated using the Solver function in Microsoft Excel. All model outputs for the full cohort using the CumNormal Michaelis-Menten model are shown in Table E-6 of the draft document. All model output are shown in Table E-6 of the draft document. There is no additional information to provide regarding these model parameters.

During discussion at the SAB meeting (6-8 Feb, 2012) it became apparent that you needed additional information regarding the Tables 1 and 2 attached to our memorandum (6 Feb 2012). Table 1 provided LPT prevalence by deciles of exposure for both the full and subcohorts analyzed from the OM Scott worker cohort. As requested we have added a column for mean TSFE for each decile of exposure to this table. This new table is provided as attachment 1 below.

Table 2 in our 6 Feb memo provided the prevalence of localized pleural thickening (LPT) by quintiles of exposure, and by quintiles of time since first exposure (TSFE). We now understand that you would like to this information cross-tabulated. Attachment 2 of this memo provides cross-tabulation of the prevalence of LPT by quintiles of exposure, further stratified by quintiles of TSFE. It is important to note that this is not the information plotted in Figure E-2 and Figure E-3 discussed during the meeting.

The five exposure groups in Figure E-2 and Figure E-3 of the draft document are not based on quintiles of exposure, but rather a priori selected categories of exposure (See page E-16 of the Draft document.) Per discussion during the SAB panel meeting we are also providing the data

plotted in Figure E-2 and Figure E-3 both by exposure and TSFE categories used in this Figure. This information is provided in Attachment 3 below.

**Attachment 1:** Prevalence of localized pleural thickening (LPT) by deciles of exposure for both the full and subcohorts analyzed from the OM Scott worker cohort.

**Attachment 2:** Prevalence of localized pleural thickening (LPT) by quintiles of exposure, and further stratified by quintiles of time since first exposure (TSFE).

**Attachment 3:** Prevalence of localized pleural thickening (LPT) for the exposure categories and TSFE categories plotted in Figure E-2 and Figure E-3 of the External Review Draft of the Toxicological Review of Libby Amphibole Asbestos.

**Attachment 1:** localized pleural thickening (LPT) prevalence by deciles of exposure for both the full and subcohorts analyzed from the OM Scott worker cohort.

**Table 1.** Localized pleural thickening (LPT) prevalence, mean time from first exposure (TSFE), and mean CHEEC<sup>a</sup> (unlagged) by decile<sup>b</sup> of exposure. All CHEEC values are in units of fibers/cc-yr. All TSFE values are in units of years.

	Number of non-cases	Number of LPT cases	Prevalence of LPT	Mean CHEEC (unlagged)	Mean TSFE
<b>Full Cohort (n=434)</b>					
Decile 1	41	2	0.0465	0.0109	7.51
Decile 2	42	1	0.0233	0.0444	14.49
Decile 3	43	1	0.0227	0.0912	18.30
Decile 4	40	3	0.0698	0.1259	25.74
Decile 5	37	6	0.1395	0.1729	31.87
Decile 6	34	10	0.2273	0.2497	33.38
Decile 7	38	6	0.1364	0.4811	25.37
Decile 8	32	11	0.2558	1.3752	26.99
Decile 9	34	10	0.2273	4.6877	28.67
Decile 10	32	11	0.2558	19.9230	32.23
<b>Subcohort (n=118)</b>					
Decile 1	10	1	0.0909	0.0145	24.87
Decile 2	13	0	0	0.0378	27.13
Decile 3	10	1	0.0909	0.0687	28.89
Decile 4	12	0	0	0.1088	29.16
Decile 5	12	0	0	0.1394	27.36
Decile 6	10	2	0.1667	0.1778	29.93
Decile 7	12	0	0	0.3038	27.80
Decile 8	10	2	0.1667	0.4205	29.02
Decile 9	10	2	0.1667	0.6254	27.16
Decile 10	7	4	0.3636	2.3951	30.77

a. CHEEC is the exposure metric of Cumulative Human Equivalent Exposure Concentration

b. Deciles calculated using the RANK procedure in SAS, among all participants (cases and non-cases)

**Attachment 2:** Prevalence of localized pleural thickening (LPT) by quintiles of exposure, and further stratified by quintiles of time since first exposure (TSFE).

**Table 2:** LPT prevalence by quintiles<sup>a</sup> of exposure and time from first exposure (TSFE). All CHEEC<sup>b</sup> values are in units of fibers/cc-yr. All TSFE values are in units of years.

	Number of non-cases	Number of LPT cases	Prevalence of LPT
<b>Full Cohort (n=434)</b>			
Quintile 1, CHEEC (0.0001-0.0640 f/cc-yr)			
Quintile 1, TSFE (0.42-9.00 yrs)	55	1	0.0179
Quintile 2, TSFE (9.41-23.14 yrs)	1	0	0
Quintile 3, TSFE (23.42-29.77 yrs)	24	2	0.0769
Quintile 4, TSFE (29.78-36.30 yrs)	3	0	0
Quintile 5, TSFE (36.37-47.34 yrs)	0	0	0
Quintile 2, CHEEC (0.0650-0.1390 f/cc-yr)			
Quintile 1, TSFE (0.42-9.00 yrs)	12	0	0
Quintile 2, TSFE (9.41-23.14 yrs)	30	1	0.0323
Quintile 3, TSFE (23.42-29.77 yrs)	20	0	0
Quintile 4, TSFE (29,78-36.30 yrs)	18	0	0
Quintile 5, TSFE (36.37-47.34 yrs)	3	3	0.50
Quintile 3, CHEEC (0.1420-0.3200 f/cc-yr)			
Quintile 1, TSFE (0.42-9.00 yrs)	4	0	0
Quintile 2, TSFE (9.41-23.14 yrs)	7	1	0.1250
Quintile 3, TSFE (23.42-29.77 yrs)	19	0	0
Quintile 4, TSFE (29,78-36.30 yrs)	18	5	0.2174
Quintile 5, TSFE (36.37-47.34 yrs)	23	10	0.3030
Quintile 4, CHEEC (0.3380-2.2420 f/cc-yr)			
Quintile 1, TSFE (0.42-9.00 yrs)	12	0	0
Quintile 2, TSFE (9.41-23.14 yrs)	16	0	0
Quintile 3, TSFE (23.42-29.77 yrs)	16	4	0.25
Quintile 4, TSFE (29,78-36.30 yrs)	20	7	0.2593
Quintile 5, TSFE (36.37-47.34 yrs)	6	6	0.50
Quintile 5, CHEEC (2.2490-34.1520 f/cc-yr)			
Quintile 1, TSFE (0.42-9.00 yrs)	2	0	0
Quintile 2, TSFE (9.41-23.14 yrs)	24	0	0
Quintile 3, TSFE (23.42-29.77 yrs)	8	1	0.1111
Quintile 4, TSFE (29,78-36.30 yrs)	10	6	0.3750
Quintile 5, TSFE (36.37-47.34 yrs)	22	14	0.6667
<b>Subcohort (n=118)</b>			
Quintile 1, CHEEC (0.001-0.051 f/cc-yr)			
Quintile 1, TSFE (23.14-25.57 yrs)	12	1	0.0763
Quintile 2, TSFE (25.64-26.81 yrs)	6	0	0
Quintile 3, TSFE (26.85-29.45 yrs)	2	0	0

Quintile 4, TSFE (29.50-30.79 yrs)	2	0	0
Quintile 5, TSFE (30.83-32.63 yrs)	1	0	0
Quintile 2, CHEEC (0.0520-0.1230 f/cc-yr)			
Quintile 1, TSFE (23.14-25.57 yrs)	1	0	0
Quintile 2, TSFE (25.64-26.81 yrs)	5	0	0
Quintile 3, TSFE (26.85-29.45 yrs)	5	0	0
Quintile 4, TSFE (29.50-30.79 yrs)	6	1	0.1429
Quintile 5, TSFE (30.83-32.63 yrs)	5	0	0
Quintile 3, CHEEC (0.1280-0.1980 f/cc-yr)			
Quintile 1, TSFE (23.14-25.57 yrs)	3	0	0
Quintile 2, TSFE (25.64-26.81 yrs)	5	0	0
Quintile 3, TSFE (26.85-29.45 yrs)	4	0	0
Quintile 4, TSFE (29.50-30.79 yrs)	5	1	0.1667
Quintile 5, TSFE (30.83-32.63 yrs)	5	1	0.1667
Quintile 4, CHEEC (0.2000-0.4730 f/cc-yr)			
Quintile 1, TSFE (23.14-25.57 yrs)	2	1	0.3333
Quintile 2, TSFE (25.64-26.81 yrs)	5	0	0
Quintile 3, TSFE (26.85-29.45 yrs)	6	0	0
Quintile 4, TSFE (29.50-30.79 yrs)	5	1	0.1667
Quintile 5, TSFE (30.83-32.63 yrs)	4	0	0
Quintile 5, CHEEC (0.4810-5.5120 f/cc-yr)			
Quintile 1, TSFE (23.14-25.57 yrs)	2	1	0.3333
Quintile 2, TSFE (25.64-26.81 yrs)	3	0	0
Quintile 3, TSFE (26.85-29.45 yrs)	5	2	0.2857
Quintile 4, TSFE (29.50-30.79 yrs)	3	0	0
Quintile 5, TSFE (30.83-32.63 yrs)	4	3	0.4286

- a. Quintiles calculated using the RANK procedure in SAS, among all participants (cases and non-cases)
- b. CHEEC is the exposure metric of Cumulative Human Equivalent Exposure Concentration

**Attachment 3:** Prevalence of localized pleural thickening (LPT) for the exposure categories and TSFE categories plotted in Figure E-2 and Figure E-3 of the External Review Draft of the Toxicological Review of Libby Amphibole Asbestos. Note that the plots were constructed with binned data, but the modeling was conducted with individual data.

The first two tables below are copies of the tables that appear to the right of the figures in the appendix.

CHEEC Bins (f/cc-  
yrs)

Bin No.	Min	Max	Mean	N	Cases	Prev
CHEEC 1	0	0.05	0.021	67	2	3.0%
CHEEC 2	0.05	0.1	0.071	44	1	2.3%
CHEEC 3	0.1	0.2	0.145	108	10	9.3%
CHEEC 4	0.2	1	0.452	101	20	19.8%
CHEEC 5	1	35	9.728	114	28	24.6%

T Bins  
(yrs)

Index	Min	Max	Mean	N	Cases	Prev
T1	0	10	4.39	87	1	1.1%
T2	10	20	12.69	53	0	0.0%
T3	20	30	25.41	123	8	6.5%
T4	30	40	34.50	118	27	22.9%
T5	40	50	45.76	53	25	47.2%

Data for Individual Cells

Number of individuals in each bin

T Bin	CHEEC					
	1	2	3	4	5	
1	47	17	6	11	6	87
2	0	7	16	7	23	53
3	20	12	43	30	18	123
4	0	8	28	39	43	118
5	0	0	15	14	24	53
	67	44	108	101	114	434

Number of  
Cases in  
each bin

T Bin	CHEEC Bin					
	1	2	3	4	5	
1	1	0	0	0	0	1
2	0	0	0	0	0	0
3	1	1	1	4	1	8
4	0	0	4	11	12	27
5	0	0	5	5	15	25
	2	1	10	20	28	61

Prevalence

T Bin		CHEEC Bin						
		1	2	3	4	5		
		0.02	0.07	0.15	0.45	9.73		
1	4.39	2.1%	0.0%	0.0%	0.0%	0.0%	1.1%	2.1%
2	12.69		0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
3	25.41	5.0%	8.3%	2.3%	13.3%	5.6%	6.5%	13.3%
4	34.50		0.0%	14.3%	28.2%	27.9%	22.9%	28.2%
5	45.76			33.3%	35.7%	62.5%	47.2%	62.5%
		3.0%	2.3%	9.3%	19.8%	24.6%		
		5.0%	8.3%	33.3%	35.7%	62.5%		