Health Risk Assessment Technical Support Document for Air Management Regulation VI Amendment

By

Air Management Services
Department of Public Health
City of Philadelphia
June 16, 2021

I. List of Toxic Air Contaminants (Hazardous Air Pollutants)

The 1981 Air Management Regulation (AMR) VI lists 99 Toxic Air Contaminants (or Hazardous Air Pollutants (HAPs)). Over time, more air pollutants were found to cause cancer and other serious health effects. Under the 1990 federal Clean Air Act (CAA) Amendments, the original list of Hazardous Air Pollutants included 189 pollutants. Since then EPA has modified the list through rulemaking to include 187 HAPs [1].

This AMR VI amendment aims to regulate an updated list of Toxic Air Contaminants originally in the Appendix to the 1981 AMR VI. The updated list of Toxic Air Contaminants (HAPs) is in the Appendix to the amended AMR VI. This list incorporates nearly all one hundred eighty seven (187) pollutants that are classified as hazardous air pollutants (HAPs) by U.S. EPA pursuant to Section 112 of the Clean Air Act, and includes additional air pollutants that have been determined to have adverse health effects by Air Management Service (AMS), taking into consideration the hazardous air pollutants listed by the New Jersey Department of Environmental Protection. It contains 217 chemical compounds and compound groups in total. The *Technical Guidelines for Air Management Regulation VI* document specifies the Reporting Threshold for each of chemical compounds (compound groups).

II. Establishing Hazardous Air Pollutants Reporting Thresholds

The objective of this section is to establish HAP Reporting Thresholds which can be used, as part of the AMS permitting process, in a health risk assessment to determine if there is the potential of HAP emissions to cause a significant health risk. A Reporting Threshold is an air pollutant emission rate (tons per year, or pounds per year) where The Philadelphia Department of Public Health (Department) has determined a health risk analysis is necessary. The methodology described below is used to determine the reporting thresholds. It is also used to establish the Risk Screening Workbook that will be used as a preliminary risk screening tool (also see Section III of *Technical Guidelines for Air Management Regulation VI*) in the permitting process. The methodology consists of the following three parts: Part 1: Modeling methodology; Part 2: Processing the modeling results; and Part 3: Identifying proposed threshold values.

2.1 Modeling Methodology

Instead of setting a reporting threshold for each HAP in an arbitrary way, air quality modeling was used to estimate highly conservative or worst-case scenarios of allowable emission rates of a HAP at which the health risks caused by the pollutant concentrations can be kept at a level that is considered negligible. These highly conservative or worst-case scenario allowable emission rates provide the basis to establish the reporting threshold.

2.1.1 Dispersion Model

A recent version of the American Meteorological Society/United States Environmental Protection

Agency Regulatory Model (AERMOD, Version 18081) was used for this evaluation. AERMOD is the US EPA preferred model for regulatory modeling applications. AERMOD is a steady-state plume model that incorporates air dispersion based on planetary boundary layer turbulence structure and scaling concepts, including treatment of both surface and elevated sources, and both simple and complex terrains.

2.1.2 Land Use

To consider different land use types (dispersion environments) in Philadelphia, AERMOD was run in both the rural and urban modes. In the urban mode, a population parameter of 1,570,000 was used. This is approximately the population of the City of Philadelphia in 2017.

2.1.3 Meteorological Data

Meteorological data sets include ground level weather observation data and upper air profile data. Data collected in the years 2010-2014 were used. The ground level data were the Philadelphia International Airport data sets; the concurrent upper air data were from the Sterling, Virginia station according to EPA air modeling protocols. Figure 1 shows the five-year wind rose based on ground level data from the Philadelphia International Airport weather station.

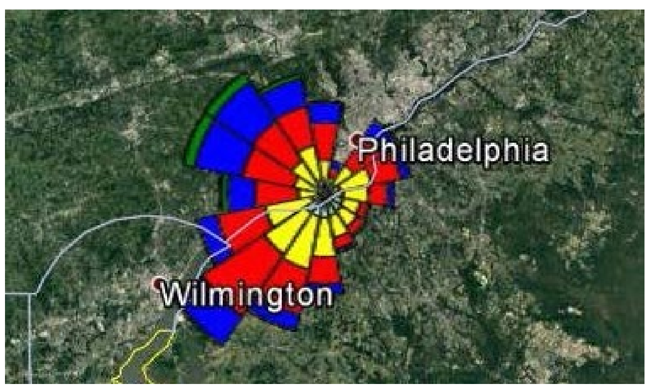

Figure 1: Wind Rose based on Philadelphia International Airport data

2.1.4 Stack Parameters and Emission Rates

Hypothetical emission points and structures were entered into the model to represent a range of pollutant release and aerodynamic downwash scenarios for stacks. The stack parameters and emission rates used to generate the normalized air impact values (micrograms per cubic meter ($\mu g/m^3$) /pound per hour of HAP emitted for short term impacts, $\mu g/m^3$ / ton per year of HAP emitted for long term impacts) are listed in Table 1. The stack gas exit velocity and exit temperature values were selected so that plume rise would be minimal to provide highly conservative estimates. Emissions were assumed to occur 24 hours per day, 365 days per year. Each modeled stack is located in the middle of a group of hypothetical buildings that are modeled for building downwash of the plume.

Table 1. Stack Parameters and Emission Rates

Parameter	Value
Normalized Annual Emission Rate	1 ton per year (normalized)
Normalized 1-Hour Emission Rate	1 pound per hour (lb/hour) (normalized)
Modeled Stack Heights (ft)	15, 20, 25, 30, 40, 50, 75, 100, 150, 200, 250
Modeled Stack Diameter	1 foot
Exit Velocity	0.33 feet per second
Exit temperature	80 degrees Fahrenheit (ºF)

2.1.5 Building Downwash

The building dimensions were selected so that the plume was subjected to aerodynamic downwash in all wind directions. The building dimensions used, including assumed horizontal dimensions, are listed in Table 2. To consider conservative plume downwash scenarios, all stacks were assumed below the Good Engineering Practice (GEP) stack height of 2.5 times the building height. For stack heights of 15 ft and 20 ft, the stack was assumed to be a factor of 1.25 times the building height. For all other stack heights (25 ft through 250 ft), the stack was assumed to be a factor of 1.5 times the building height. For stack heights between 15 and 50 ft, the building's horizontal dimensions were assumed constant at 50 ft. As stack heights increase above 50 ft, the building's horizontal dimensions also increase. The assumed building's horizontal dimensions are also shown in Table 2.

The US EPA's Building Profile Input Program (BPIP-PRIME) was used to generate building downwash parameters for input into AERMOD.

Table 2. Stack Heights and Assumed Building Dimensions

Stack Height (ft)	Building Height (ft)	Building Width and Length (ft)
15	12	50 x 50
20	16	50 x 50
25	16.7	50 x 50
30	20	50 x 50
40	26.7	50 x 50
50	33.4	50 x 50
75	50	75 x 75
100	66.7	100 x 100
150	100	150 x 150
200	133.4	200 x 200
250	166.7	200 x 200

2.1.6 Receptor Grid

Modeling was performed assuming flat terrain within the modeled distance range. A polar receptor grid with 864 receptors was used that was centered on the stack (midpoint of the buildings) with 36 radials spaced every 10 degrees. The spacing of receptors along the radials were as follows to provide 24 distances: 20 ft, 30 ft, 40 ft, 50 ft, 60 ft, 70 ft, 80 ft, 90 ft, 100 ft, 150 ft, 200 ft, 250 ft, 300 ft, 400 ft, 500 ft, 600 ft, 700 ft, 800 ft, 900 ft, 1000 ft, 1500 ft, 2000 ft, 2500 ft, 3000 ft.

2.1.7 Model Input and Output

The AERMOD model was run with EPA's regulatory default parameters and the parameters discussed above. AERMOD was run to calculate hourly, daily (24-hour), and annual concentrations at each receptor location.

2.2 Processing Modeling Results

The above modeling methodology resulted in the following number of scenarios (impacts) being modeled:

2 dispersion environments x 5 sets of MET data x 2 normalized emission rates x 3 averaging times x 11 stack heights x 864 receptors = **570,240** impacts

In order to process such a large amount of data results, the AERMOD output files were reformatted and merged using a DOS batch processing script, then imported into Microsoft Excel. Statistical and pivot table functions in Excel were used to process the data. For each averaging time and each combination of stack height and receptor distance, the maximum normalized concentration was identified. For stack heights and distances not explicitly modeled (e.g. stack height 21 feet), linear interpolation across stack heights for a specified distance was performed to generate estimated concentration values. Similarly, concentrations at distances not explicitly modeled (e.g. 110 feet) were also estimated using linear interpolation.

Using this process, tables of worst-case hourly and annual impacts by stack height and distance were created for stacks from 15 ft to 250 ft and distances from 20 ft to 3,000 ft, including interpolated values. This resulted in 2,550 values in one table (Figure 2, normalized annual impacts). Each value represents the maximum concentration for a particular stack height and distance combination. However, for the purpose of setting HAP reporting threshold values, it is expected that the overall worst-case impacts will occur from shorter stacks at distances closer to the stack. Review of the AMS permitting and emission inventory data showed that at least 57% of approximately 1100 stacks (or release points) permitted in Philadelphia (not including small sources that are not reported in the emission inventories) are no more than 40 feet high. Of these stacks, at least 43% are located 150 feet or less from the closest facility property line. Based on this analysis, only hourly and annual impacts for stacks no more than 40 ft and within 150 ft from the property line were considered. Again, this was meant to use more conservative scenarios in establishing reporting thresholds. In Figure 2, the area bounded by the blue box represents the subset of values used to establish the HAP reporting thresholds.

Stack Height (ft)

Distance from	15	16	17	18	19	20	21	22	23	24	25	26	27
0	43.850	41.751	39.652	37.553	35.454	33.355	33.926	34.496	35.067	35.637	36.208	34.866	33.524
20	43.850	41.751	39.652	37.553	35.454	33.355	33.926	34.496	35.067	35.637	36.208	34.866	33.524
25	42.504	40.497	38.490	36.482	34.475	32.468	33.006	33.544	34.081	34.619	35.157	33.870	32.583
30	41.158	39.243	37.327	35.412	33.496	31.581	32.086	32.591	33.096	33.601	34.107	32.874	31.642
35	39.485	37.677	35.869	34.061	32.254	30.446	30.914	31.382	31.850	32.318	32.785	31.618	30.451
40	37.811	36.111	34.411	32.711	31.011	29.311	29.742	30.173	30.603	31.034	31.464	30.362	29.260
45	36.044	34.452	32.859	31.266	29.673	28.080	28.475	28.870	29.265	29.659	30.054	29.017	27.981
50	34.278	32.792	31.306	29.821	28.335	26.849	27.208	27.567	27.926	28.285	28.644	27.673	26.701
55	32.596	31.206	29.815	28.425	27.034	25.644	25.972	26.301	26.629	26.957	27.286	26.374	25.461
60	30.915	29.620	28.324	27.029	25.734	24.438	24.736	25.034	25.332	25.630	25.928	25.075	24.221
65	29.424	28.209	26.993	25.778	24.563	23.348	23.620	23.893	24.165	24.437	24.709	23.905	23.101
70	27.932	26.797	25.662	24.527	23.392	22.257	22.504	22.751	22.998	23.244	23.491	22.736	21.981
75	26.686	25.613	24.541	23.468	22.395	21.322	21.547	21.772	21.998	22.223	22.448	21.732	21.015
80	25.440	24.429	23.419	22.408	21.397	20.386	20.590	20.794	20.998	21.201	21.405	20.728	20.050
85	24.398	23.434	22.469	21.505	20.541	19.577	19.768	19.958	20.149	20.340	20.530	19.883	19.236
90	23.355	22.438	21.520	20.603	19.685	18.768	18.945	19.123	19.300	19.478	19.655	19.038	18.421
95	22.467	21.584	20.702	19.819	18.937	18.055	18.224	18.394	18.563	18.733	18.902	18.310	17.718
100	21.578	20.730	19.883	19.036	18.189	17.341	17.503	17.665	17.826	17.988	18.149	17.582	17.014
110	20.363	19.567	18.771	17.974	17.178	16.382	16.521	16.659	16.797	16.935	17.074	16.542	16.010
120	19.148	18.403	17.658	16.913	16.168	15.423	15.538	15.653	15.768	15.883	15.998	15.502	15.005
130	17.933	17.239	16.546	15.852	15.158	14.464	14.556	14.647	14.739	14.830	14.922	14.461	14.001
140	16.718	16.075	15.433	14.791	14.148	13.506	13.574	13.642	13.710	13.778	13.846	13.421	12.997
150	15.503	14.912	14.320	13.729	13.138	12.547	12.591	12.636	12.681	12.725	12.770	12.381	11.993
160	13.605	13.165	12.725	12.285	11.845	11.405	11.358	11.311	11.264	11.217	11.170	10.897	10.623
170	11.708	11.419	11.130	10.841	10.552	10.264	10.125	9.987	9.848	9.709	9.571	9.412	9.254
180	9.810	9.672	9.535	9.397	9.260	9.122	8.892	8.662	8.432	8.202	7.971	7.928	7.884
190	7.912	7.926	7.940	7.953	7.967	7.981	7.659	7.337	7.015	6.694	6.372	6.443	6.515
200	6.015	6.179	6.344	6.509	6.674	6.839	6.426	6.012	5.599	5.186	4.772	4.959	5.145
225	5.185	5.207	5.230	5.252	5.274	5.296	5.051	4.806	4.561	4.316	4.071	4.126	4.181
250	4.356	4.236	4.115	3.994	3.874	3.753	3.677	3.600	3.524	3.447	3.370	3.294	3.218
275	3.885	3.781	3.677	3.573	3.470	3.366	3.296	3.227	3.157	3.088	3.018	2.952	2.886
300	3.413	3.326	3.239	3.152	3.065	2.978	2.916	2.853	2.791	2.729	2.666	2.610	2.554
350	2.865	2.796	2.727	2.657	2.588	2.519	2.466	2.412	2.359	2.306	2.253	2.207	2.161
400	2.317	2.266	2.214	2.163	2.111	2.060	2.015	1.971	1.927	1.883	1.839	1.804	1.768
450	2.005	1.965	1.924	1.884	1.844	1.803	1.764	1.724	1.685	1.646	1.606	1.577	1.548
500	1.693	1.664	1.635	1.605	1.576	1.547	1.512	1.477	1.443	1.408	1.374	1.350	1.327
550	1.480	1.459	1.438	1.417	1.397	1.376	1.344	1.312	1.279	1.247	1.215	1.196	1.178
600	1.266	1.254	1.242	1.230	1.217	1.205	1.175	1.146	1.116	1.086	1.057	1.042	1.028
650	1.121	1.114	1.107	1.099	1.092	1.085	1.057	1.029	1.001	0.973	0.945	0.934	0.923
700	0.976	0.974	0.971	0.969	0.966	0.964	0.938	0.912	0.886	0.859	0.833	0.825	0.817
750	0.874	0.874	0.873	0.873	0.872	0.872	0.848	0.824	0.799	0.775	0.751	0.745	0.739
800	0.772	0.773	0.775	0.777	0.778	0.780	0.758	0.736	0.713	0.691	0.669	0.665	0.660
850	0.721	0.719	0.716	0.714	0.712	0.709	0.689	0.668	0.648	0.627	0.606	0.603	0.600
900	0.670	0.664	0.658	0.652	0.645	0.639	0.620	0.601	0.582	0.563	0.544	0.542	0.540
950	0.628	0.619	0.610	0.601	0.592	0.582	0.568	0.553	0.538	0.524	0.509	0.505	0.502
1000	0.586	0.574	0.562	0.550	0.538	0.526	0.515	0.505	0.495	0.485	0.474	0.469	0.463
1500	0.328	0.322	0.316	0.309	0.303	0.297	0.296	0.296	0.295	0.295	0.294	0.287	0.279
2000	0.204	0.203	0.202	0.200	0.199	0.198	0.197	0.196	0.195	0.194	0.193	0.190	0.188
2500	0.140	0.140	0.139	0.139	0.139	0.138	0.138	0.137	0.137	0.136	0.135	0.134	0.133
3000	0.103	0.103	0.103	0.102	0.102	0.102	0.102	0.102	0.101	0.101	0.101	0.100	0.099

Stack Height (ft)

Distance from	28	29	30	32	34	36	38	40	42	44	46	48	50
0	32.182	30.840	29.499	27.627	25.756	23.885	22.014	20.143	18.910	17.677	16.443	15.210	13.977
20	32.182	30.840	29.499	27.627	25.756	23.885	22.014	20.143	18.910	17.677	16.443	15.210	13.977
25	31.296	30.009	28.722	26.909	25.097	23.284	21.471	19.659	18.465	17.271	16.077	14.883	13.689
30	30.410	29.178	27.946	26.191	24.437	22.683	20.928	19.174	18.020	16.865	15.711	14.557	13.402
35	29.284	28.117	26.950	25.268	23.587	21.905	20.224	18.542	17.436	16.330	15.224	14.118	13.012
40	28.158	27.056	25.954	24.346	22.737	21.128	19.519	17.911	16.853	15.795	14.737	13.679	12.621
45	26.944	25.908	24.871	23.339	21.808	20.276	18.744	17.213	16.205	15.197	14.189	13.181	12.173
50	25.730	24.759	23.788	22.333	20.879	19.424	17.969	16.515	15.557	14.599	13.641	12.683	11.725
55	24.549	23.637	22.724	21.343	19.962	18.581	17.200	15.819	14.908	13.997	13.086	12.175	11.264
60	23.368	22.514	21.661	20.353	19.046	17.738	16.430	15.122	14.258	13.394	12.530	11.666	10.802
65	22.297	21.492	20.688	19.445	18.203	16.960	15.717	14.475	13.652	12.829	12.007	11.184	10.361
70	21.225	20.470	19.715	18.537	17.360	16.182	15.005	13.827	13.046	12.264	11.483	10.701	9.920
75	20.299	19.583	18.866	17.744	16.621	15.499	14.376	13.253	12.508	11.763	11.019	10.274	9.529
80	19.373	18.695	18.018	16.950	15.882	14.815	13.747	12.679	11.971	11.263	10.554	9.846	9.137
85	18.589	17.941	17.294	16.272	15.249	14.227	13.205	12.183	11.506	10.830	10.153	9.477	8.800
90	17.804	17.187	16.570	15.593	14.616	13.640	12.663	11.686	11.041	10.397	9.752	9.108	8.463
95	17.125	16.533	15.940	15.002	14.064	13.125	12.187	11.248	10.631	10.013	9.396	8.778	8.160
100	16.446	15.878	15.310	14.411	13.511	12.611	11.711	10.811	10.220	9.630	9.039	8.448	7.858
110	15.478	14.946	14.414	13.564	12.715	11.866	11.017	10.168	9.612	9.057	8.501	7.945	7.390
120	14.509	14.013	13.517	12.718	11.920	11.121	10.323	9.524	9.004	8.484	7.963	7.443	6.922
130	13.541	13.080	12.620	11.872	11.124	10.377	9.629	8.881	8.396	7.910	7.425	6.940	6.455
140	12.572	12.148	11.723	11.026	10.329	9.632	8.935	8.238	7.788	7.337	6.887	6.437	5.987
150	11.604	11.215	10.827	10.180	9.534	8.887	8.241	7.594	7.179	6.764	6.349	5.935	5.520
160	10.349	10.076	9.802	9.292	8.782	8.272	7.762	7.252	6.862	6.472	6.082	5.692	5.302
170	9.095	8.936	8.777	8.404	8.031	7.657	7.284	6.910	6.545	6.180	5.815	5.449	5.084
180	7.840	7.797	7.753	7.516	7.279	7.042	6.805	6.569	6.228	5.888	5.547	5.207	4.866
190	6.586	6.657	6.728	6.628	6.528	6.427	6.327	6.227	5.911	5.595	5.280	4.964	4.648
200	5.331	5.518	5.704	5.740	5.776	5.812	5.849	5.885	5.594	5.303	5.012	4.721	4.431
225	4.236	4.291	4.346	4.294	4.243	4.191	4.139	4.087	3.894	3.700	3.507	3.314	3.120
250	3.141	3.065	2.988	2.849	2.709	2.569	2.430	2.290	2.194	2.098	2.002	1.906	1.810
275	2.820	2.754	2.687	2.565	2.442	2.320	2.197	2.074	1.986	1.898	1.809	1.721	1.633
300	2.498	2.442	2.386	2.281	2.175	2.070	1.964	1.859	1.778	1.698	1.617	1.537	1.456
350	2.116	2.070	2.024	1.937	1.850	1.763	1.676	1.589	1.522	1.456	1.389	1.323	1.256
400	1.733	1.697	1.662	1.593	1.525	1.456	1.387	1.319	1.266	1.214	1.161	1.109	1.057
450	1.518	1.489	1.459	1.400	1.340	1.281	1.221	1.162	1.116	1.071	1.025	0.979	0.934
500	1.304	1.280	1.257	1.207	1.156	1.106	1.055	1.005	0.966	0.927	0.889	0.850	0.811
550	1.159	1.140	1.121	1.078	1.034	0.990	0.946	0.902	0.869	0.835	0.801	0.767	0.734
600	1.014	1.000	0.986	0.948	0.911	0.874	0.837	0.800	0.771	0.742	0.714	0.685	0.656
650	0.912	0.901	0.890	0.858	0.826	0.794	0.762	0.730	0.704	0.678	0.652	0.626	0.600
700	0.810	0.802	0.794	0.767	0.740	0.714	0.687	0.660	0.637	0.614	0.590	0.567	0.544
750	0.733	0.727	0.721	0.698	0.676	0.654	0.632	0.610	0.588	0.567	0.546	0.524	0.503
800	0.656	0.652	0.647	0.630	0.612	0.594	0.577	0.559	0.540	0.520	0.501	0.481	0.462
850	0.597	0.594	0.591	0.577	0.562	0.548	0.533	0.518	0.501	0.483	0.466	0.448	0.431
900	0.539	0.537	0.536	0.524	0.512	0.501	0.489	0.477	0.462	0.446	0.431	0.415	0.400
950	0.498	0.494	0.491	0.481	0.472	0.462	0.453	0.443	0.430	0.416	0.402	0.388	0.374
1000	0.457	0.451	0.446	0.439	0.431	0.424	0.417	0.409	0.397	0.385	0.373	0.360	0.348
1500	0.272	0.265	0.257	0.248	0.239	0.229	0.220	0.211	0.207	0.202	0.198	0.194	0.190
2000	0.185	0.182	0.180	0.171	0.163	0.155	0.147	0.139	0.134	0.130	0.125	0.121	0.116
2500	0.132	0.131	0.130	0.125	0.121	0.117	0.113	0.108	0.104	0.100	0.095	0.091	0.087
3000	0.099	0.098	0.098	0.095	0.093	0.091	0.089	0.086	0.083	0.080	0.077	0.074	0.071

Stack Height (ft)

Distance from	55	60	65	70	75	80	85	90	95	100	110	120	130	140
0	12.333	10.689	9.045	7.400	5.756	5.207	4.658	4.109	3.560	3.011	2.651	2.292	1.932	1.572
20	12.333	10.689	9.045	7.400	5.756	5.207	4.658	4.109	3.560	3.011	2.651	2.292	1.932	1.572
25	12.093	10.497	8.901	7.305	5.709	5.167	4.625	4.083	3.542	3.000	2.642	2.284	1.927	1.569
30	11.854	10.306	8.757	7.209	5.661	5.126	4.592	4.057	3.523	2.989	2.633	2.277	1.922	1.566
35	11.526	10.041	8.556	7.071	5.586	5.063	4.539	4.015	3.492	2.968	2.616	2.264	1.912	1.560
40	11.199	9.777	8.355	6.933	5.511	4.999	4.486	3.973	3.461	2.948	2.600	2.251	1.902	1.554
45	10.822	9.470	8.118	6.767	5.415	4.916	4.417	3.918	3.419	2.920	2.576	2.232	1.888	1.545
50	10.444	9.163	7.881	6.600	5.319	4.833	4.348	3.863	3.377	2.892	2.553	2.214	1.875	1.535
55	10.052	8.841	7.629	6.418	5.206	4.737	4.267	3.797	3.327	2.857	2.524	2.191	1.857	1.524
60	9.661	8.519	7.377	6.236	5.094	4.640	4.185	3.731	3.277	2.823	2.495	2.167	1.840	1.512
65	9.283	8.205	7.127	6.050	4.972	4.534	4.096	3.658	3.220	2.782	2.461	2.140	1.819	1.498
70	8.906	7.892	6.878	5.864	4.849	4.428	4.006	3.585	3.163	2.742	2.427	2.113	1.799	1.484
75	8.567	7.606	6.645	5.684	4.723	4.318	3.913	3.507	3.102	2.697	2.390	2.083	1.776	1.468
80	8.229	7.321	6.412	5.504	4.596	4.207	3.819	3.430	3.041	2.653	2.353	2.053	1.753	1.453
85	7.934	7.068	6.202	5.336	4.469	4.097	3.724	3.351	2.978	2.605	2.313	2.020	1.728	1.435
90	7.639	6.815	5.991	5.167	4.343	3.986	3.629	3.272	2.915	2.558	2.273	1.988	1.703	1.418
95	7.373	6.585	5.797	5.009	4.221	3.878	3.536	3.194	2.851	2.509	2.231	1.954	1.677	1.400
100	7.106	6.354	5.602	4.850	4.099	3.771	3.443	3.115	2.787	2.460	2.190	1.920	1.651	1.381
110	6.693	5.996	5.300	4.603	3.906	3.598	3.290	2.982	2.673	2.365	2.109	1.854	1.598	1.342
120	6.281	5.639	4.997	4.356	3.714	3.425	3.137	2.848	2.559	2.271	2.029	1.787	1.545	1.303
130	5.868	5.281	4.695	4.108	3.521	3.252	2.983	2.714	2.445	2.176	1.948	1.720	1.492	1.264
140	5.456	4.924	4.392	3.861	3.329	3.080	2.830	2.581	2.331	2.082	1.867	1.653	1.439	1.225
150	5.043	4.566	4.090	3.613	3.137	2.907	2.677	2.447	2.217	1.987	1.787	1.586	1.386	1.186
160	4.841	4.380	3.920	3.459	2.998	2.782	2.566	2.349	2.133	1.917	1.725	1.533	1.342	1.150
170	4.639	4.194	3.750	3.305	2.860	2.657	2.454	2.252	2.049	1.846	1.663	1.481	1.298	1.115
180	4.437	4.008	3.579	3.151	2.722	2.532	2.343	2.154	1.965	1.775	1.601	1.428	1.254	1.080
190	4.235	3.822	3.409	2.996	2.583	2.408	2.232	2.056	1.880	1.705	1.540	1.375	1.210	1.045
200	4.033	3.636	3.239	2.842	2.445	2.283	2.121	1.958	1.796	1.634	1.478	1.322	1.166	1.010
225	2.943	2.767	2.590	2.413	2.237	2.088	1.940	1.792	1.644	1.495	1.356	1.216	1.076	0.937
250	1.853	1.897	1.941	1.984	2.028	1.894	1.760	1.625	1.491	1.357	1.234	1.110	0.987	0.864
275	1.685	1.737	1.789	1.841	1.893	1.765	1.637	1.510	1.382	1.254	1.143	1.031	0.920	0.808
300	1.516	1.577	1.637	1.697	1.758	1.636	1.515	1.394	1.273	1.152	1.052	0.952	0.852	0.752
350	1.244	1.231	1.218	1.205	1.193	1.161	1.130	1.098	1.067	1.035	0.944	0.853	0.762	0.671
400	0.971	0.885	0.799	0.714	0.628	0.686	0.744	0.802	0.860	0.918	0.836	0.754	0.672	0.590
450	0.859	0.784	0.709	0.635	0.560	0.574	0.589	0.604	0.619	0.633	0.600	0.566	0.532	0.498
500	0.747	0.683	0.620	0.556	0.492	0.463	0.435	0.406	0.378	0.349	0.363	0.377	0.392	0.406
550	0.676	0.619	0.561	0.503	0.446	0.419	0.392	0.366	0.339	0.312	0.328	0.345	0.361	0.377
600	0.605	0.554	0.503	0.451	0.400	0.375	0.350	0.325	0.300	0.275	0.294	0.312	0.331	0.349
650	0.553	0.507	0.460	0.413	0.367	0.344	0.321	0.299	0.276	0.253	0.262	0.271	0.279	0.288
700	0.502	0.460	0.417	0.375	0.333	0.313	0.292	0.272	0.252	0.232	0.231	0.229	0.228	0.227
750	0.464	0.426	0.387	0.348	0.310	0.291	0.272	0.253	0.234	0.215	0.207	0.199	0.191	0.183
800	0.427	0.392	0.357	0.321	0.286	0.269	0.251	0.233	0.216	0.198	0.183	0.169	0.154	0.140
850	0.398	0.366	0.333	0.301	0.268	0.252	0.235	0.218	0.202	0.185	0.171	0.158	0.144	0.130
900	0.370	0.340	0.310	0.280	0.250	0.235	0.219	0.203	0.188	0.172	0.159	0.146	0.133	0.120
950	0.346	0.319	0.291	0.263	0.235	0.221	0.206	0.191	0.177	0.162	0.150	0.137	0.125	0.113
1000	0.323	0.297	0.272	0.246	0.221	0.207	0.193	0.179	0.166	0.152	0.140	0.129	0.117	0.105
1500	0.179	0.168	0.157	0.146	0.135	0.127	0.119	0.111	0.103	0.095	0.087	0.079	0.071	0.064
2000	0.111	0.106	0.101	0.097	0.092	0.087	0.082	0.077	0.072	0.067	0.061	0.056	0.050	0.045
2500	0.082	0.078	0.074	0.070	0.065	0.062	0.059	0.056	0.053	0.050	0.046	0.042	0.038	0.034
3000	0.067	0.062	0.057	0.053	0.048	0.046	0.044	0.042	0.040	0.038	0.036	0.033	0.030	0.027

Stack Height (ft)

Distance from	150	160	170	180	190	200	210	220	230	240	250
0	1.212	1.097	0.981	0.865	0.750	0.634	0.583	0.531	0.480	0.428	0.377
20	1.212	1.097	0.981	0.865	0.750	0.634	0.583	0.531	0.480	0.428	0.377
25	1.211	1.096	0.981	0.865	0.750	0.634	0.583	0.531	0.480	0.429	0.377
30	1.210	1.095	0.980	0.865	0.750	0.634	0.583	0.532	0.480	0.429	0.378
35	1.208	1.093	0.978	0.863	0.749	0.634	0.583	0.531	0.480	0.429	0.378
40	1.205	1.091	0.976	0.862	0.748	0.633	0.582	0.531	0.480	0.429	0.378
45	1.201	1.087	0.973	0.860	0.746	0.632	0.581	0.531	0.480	0.429	0.378
50	1.196	1.083	0.970	0.857	0.744	0.631	0.581	0.530	0.479	0.428	0.377
55	1.190	1.078	0.966	0.854	0.742	0.630	0.579	0.529	0.478	0.428	0.377
60	1.184	1.073	0.962	0.851	0.740	0.629	0.578	0.528	0.477	0.427	0.377
65	1.177	1.067	0.957	0.847	0.737	0.627	0.577	0.526	0.476	0.426	0.376
70	1.170	1.061	0.952	0.843	0.734	0.625	0.575	0.525	0.475	0.425	0.376
75	1.161	1.053	0.946	0.838	0.730	0.622	0.573	0.523	0.474	0.424	0.375
80	1.153	1.046	0.939	0.833	0.726	0.620	0.571	0.522	0.472	0.423	0.374
85	1.143	1.038	0.932	0.827	0.722	0.617	0.568	0.520	0.471	0.422	0.373
90	1.133	1.029	0.925	0.822	0.718	0.614	0.566	0.517	0.469	0.421	0.372
95	1.122	1.020	0.918	0.815	0.713	0.611	0.563	0.515	0.467	0.419	0.371
100	1.111	1.011	0.910	0.809	0.709	0.608	0.560	0.513	0.465	0.418	0.370
110	1.086	0.989	0.892	0.794	0.697	0.599	0.553	0.507	0.460	0.414	0.367
120	1.061	0.967	0.873	0.779	0.685	0.591	0.546	0.500	0.455	0.409	0.364
130	1.036	0.945	0.855	0.764	0.673	0.583	0.538	0.494	0.450	0.405	0.361
140	1.010	0.923	0.836	0.749	0.662	0.575	0.531	0.488	0.444	0.401	0.358
150	0.985	0.901	0.818	0.734	0.650	0.566	0.524	0.482	0.439	0.397	0.355
160	0.959	0.878	0.798	0.717	0.637	0.556	0.515	0.474	0.433	0.391	0.350
170	0.932	0.855	0.778	0.701	0.623	0.546	0.506	0.466	0.426	0.386	0.346
180	0.906	0.832	0.758	0.684	0.610	0.536	0.497	0.458	0.419	0.381	0.342
190	0.880	0.809	0.738	0.667	0.596	0.526	0.488	0.450	0.413	0.375	0.337
200	0.854	0.786	0.718	0.651	0.583	0.515	0.479	0.443	0.406	0.370	0.333
225	0.797	0.735	0.674	0.612	0.551	0.489	0.456	0.422	0.388	0.355	0.321
250	0.740	0.685	0.629	0.574	0.519	0.463	0.432	0.401	0.371	0.340	0.309
275	0.696	0.645	0.593	0.542	0.491	0.439	0.411	0.382	0.354	0.325	0.297
300	0.652	0.605	0.557	0.510	0.463	0.415	0.389	0.363	0.337	0.311	0.285
350	0.580	0.540	0.499	0.459	0.418	0.378	0.355	0.332	0.309	0.286	0.263
400	0.508	0.475	0.441	0.408	0.374	0.341	0.321	0.301	0.281	0.261	0.241
450	0.464	0.434	0.403	0.373	0.342	0.312	0.294	0.276	0.258	0.240	0.222
500	0.420	0.392	0.365	0.338	0.310	0.283	0.267	0.251	0.235	0.219	0.203
550	0.394	0.367	0.341	0.315	0.288	0.262	0.247	0.232	0.217	0.201	0.186
600	0.368	0.342	0.317	0.291	0.266	0.240	0.226	0.212	0.198	0.184	0.170
650	0.297	0.282	0.268	0.253	0.239	0.225	0.212	0.199	0.186	0.173	0.160
700	0.226	0.222	0.219	0.216	0.212	0.209	0.197	0.185	0.173	0.161	0.149
750	0.175	0.180	0.185	0.191	0.196	0.201	0.189	0.177	0.165	0.154	0.142
800	0.125	0.139	0.152	0.165	0.179	0.192	0.181	0.169	0.158	0.146	0.135
850	0.116	0.126	0.137	0.147	0.157	0.168	0.160	0.153	0.145	0.137	0.130
900	0.107	0.114	0.122	0.129	0.136	0.143	0.140	0.136	0.132	0.129	0.125
950	0.100	0.102	0.103	0.105	0.106	0.108	0.107	0.106	0.106	0.105	0.105
1000	0.094	0.089	0.085	0.081	0.076	0.072	0.074	0.077	0.079	0.082	0.084
1500	0.056	0.053	0.050	0.047	0.045	0.042	0.040	0.039	0.037	0.036	0.034
2000	0.040	0.037	0.035	0.033	0.030	0.028	0.027	0.026	0.025	0.024	0.023
2500	0.030	0.028	0.027	0.025	0.023	0.021	0.020	0.020	0.019	0.018	0.017
3000	0.024	0.023	0.021	0.020	0.018	0.017	0.016	0.016	0.015	0.014	0.014

Figure 2. Modeling Results (Annual) Table: maximum concentration for each combination of stack height and distance -- HAP reporting thresholds to be based on concentrations caused by stacks no more than 40 feet high and within a distance of no more than 150 feet from stack to property line

2.3 <u>Identifying Proposed Reporting Threshold Values</u>

2.3.1 Concentration Percentile-based Threshold Values

Rather than arbitrarily basing the proposed HAP reporting thresholds on a single stack height/property-line combination, a robust statistical approach was utilized. This approach considered all modeled stack height/property-line distance combinations predicted for stacks no more than 40 ft high and property lines no more than 150 ft from the stack. A percentage frequency distribution of the modeled impacts was evaluated. The resulting percentiles represent conservative concentration scenarios that could reasonably be expected to occur for multiple stack property-line combinations. This subset of data contains normalized air concentration values for more than 570 combinations of stack heights and receptor distances. To generate candidate values of HAP reporting thresholds, the 85th, 90th, 95th and 98th percentiles of the modeled concentrations of this dataset were evaluated. Figure 3 shows the distribution of modeled normalized annual impacts. A percentile identifies the normalized air concentration value where the percentage of modeled impacts in the dataset are less than the indicated air concentration value. Based on this chart, the 98th percentile of normalized annual concentrations is at 37.7 µg/m^3 per ton/year pollutant emission, which represents a highly conservative scenario. Figures 4 shows the data table of combinations of stack height and distances with the 85th, 90th, 95th and 98th percentiles. They are 29.3, 31.6, 34.3 and 37.7 µg/m^3 per ton/year respectively.

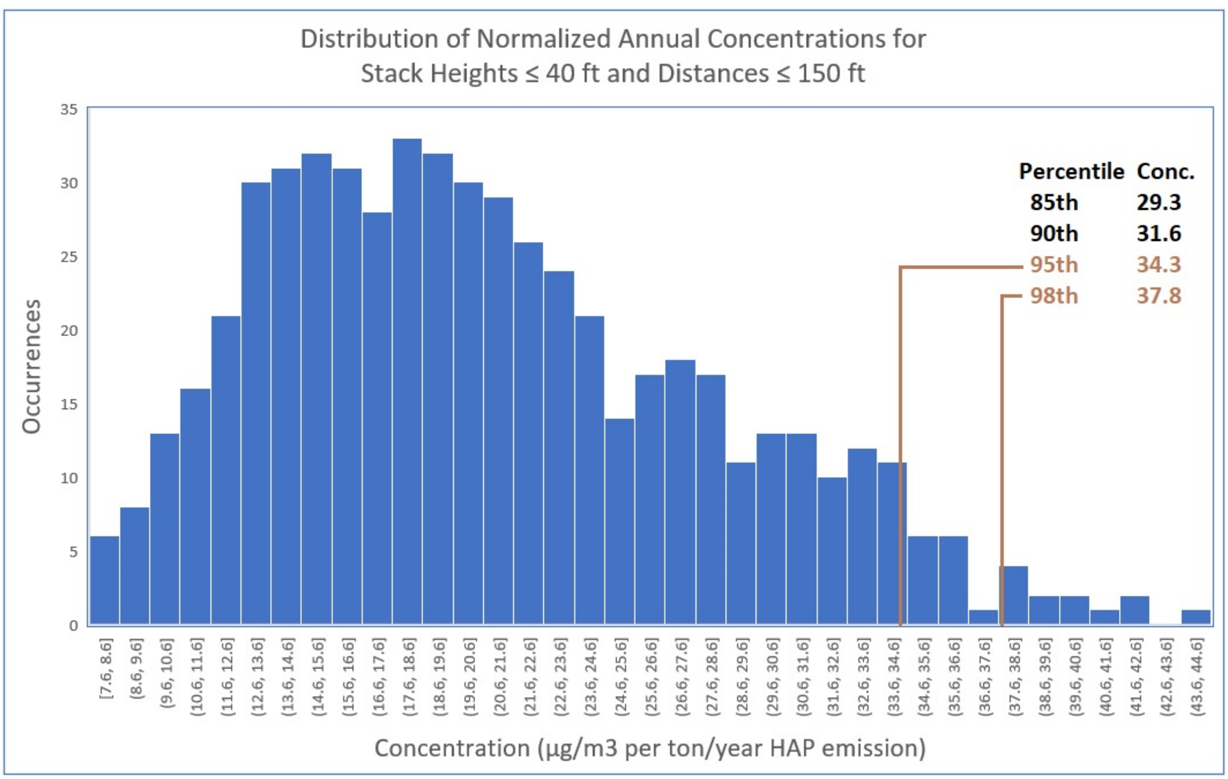

Figure 3. Percentage distribution of normalized annual concentrations

	Stack Height (ft)																									
Distance (ft)	**15**	**16**	**17**	**18**	**19**	**20**	**21**	**22**	**23**	**24**	**25**	**26**	**27**	**28**	**29**	**30**	**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
20	43.85	41.75	39.65	37.55	35.45	33.36	33.93	34.50	35.07	35.64	36.21	34.87	33.52	32.18	30.84	29.50	28.56	27.63	26.69	25.76	24.82	23.89	22.95	22.01	21.08	20.14
25	42.50	40.50	38.49	36.48	34.48	32.47	33.01	33.54	34.08	34.62	35.16	33.87	32.58	31.30	30.01	28.72	27.82	26.91	26.00	25.10	24.19	23.28	22.38	21.47	20.56	19.66
30	41.16	39.24	37.33	35.41	33.50	31.58	32.09	32.59	33.10	33.60	34.11	32.87	31.64	30.41	29.18	27.95	27.07	26.19	25.31	24.44	23.56	22.68	21.81	20.93	20.05	19.17
35	39.48	37.68	35.87	34.06	32.25	30.45	30.91	31.38	31.85	32.32	32.79	31.62	30.45	29.28	28.12	26.95	26.11	25.27	24.43	23.59	22.75	21.91	21.06	20.22	19.38	18.54
40	37.81	36.11	34.41	32.71	31.01	29.31	29.74	30.17	30.60	31.03	31.46	30.36	29.26	28.16	27.06	25.95	25.15	24.35	23.54	22.74	21.93	21.13	20.32	19.52	18.71	17.91
45	36.04	34.45	32.86	31.27	29.67	28.08	28.48	28.87	29.26	29.66	30.05	29.02	27.98	26.94	25.91	24.87	24.11	23.34	22.57	21.81	21.04	20.28	19.51	18.74	17.98	17.21
50	34.28	32.79	31.31	29.82	28.33	26.85	27.21	27.57	27.93	28.28	28.64	27.67	26.70	25.73	24.76	23.79	23.06	22.33	21.61	20.88	20.15	19.42	18.70	17.97	17.24	16.51
55	32.60	31.21	29.82	28.42	27.03	25.64	25.97	26.30	26.63	26.96	27.29	26.37	25.46	24.55	23.64	22.72	22.03	21.34	20.65	19.96	19.27	18.58	17.89	17.20	16.51	15.82
60	30.92	29.62	28.32	27.03	25.73	24.44	24.74	25.03	25.33	25.63	25.93	25.07	24.22	23.37	22.51	21.66	21.01	20.35	19.70	19.05	18.39	17.74	17.08	16.43	15.78	15.12
65	29.42	28.21	26.99	25.78	24.56	23.35	23.62	23.89	24.16	24.44	24.71	23.91	23.10	22.30	21.49	20.69	20.07	19.45	18.82	18.20	17.58	16.96	16.34	15.72	15.10	14.47
70	27.93	26.80	25.66	24.53	23.39	22.26	22.50	22.75	23.00	23.24	23.49	22.74	21.98	21.23	20.47	19.72	19.13	18.54	17.95	17.36	16.77	16.18	15.59	15.00	14.42	13.83
75	26.69	25.61	24.54	23.47	22.39	21.32	21.55	21.77	22.00	22.22	22.45	21.73	21.02	20.30	19.58	18.87	18.31	17.74	17.18	16.62	16.06	15.50	14.94	14.38	13.81	13.25
80	25.44	24.43	23.42	22.41	21.40	20.39	20.59	20.79	21.00	21.20	21.41	20.73	20.05	19.37	18.70	18.02	17.48	16.95	16.42	15.88	15.35	14.81	14.28	13.75	13.21	12.68
85	24.40	23.43	22.47	21.51	20.54	19.58	19.77	19.96	20.15	20.34	20.53	19.88	19.24	18.59	17.94	17.29	16.78	16.27	15.76	15.25	14.74	14.23	13.72	13.20	12.69	12.18
90	23.36	22.44	21.52	20.60	19.69	18.77	18.95	19.12	19.30	19.48	19.66	19.04	18.42	17.80	17.19	16.57	16.08	15.59	15.10	14.62	14.13	13.64	13.15	12.66	12.17	11.69
95	22.47	21.58	20.70	19.82	18.94	18.05	18.22	18.39	18.56	18.73	18.90	18.31	17.72	17.13	16.53	15.94	15.47	15.00	14.53	14.06	13.59	13.13	12.66	12.19	11.72	11.25
100	21.58	20.73	19.88	19.04	18.19	17.34	17.50	17.66	17.83	17.99	18.15	17.58	17.01	16.45	15.88	15.31	14.86	14.41	13.96	13.51	13.06	12.61	12.16	11.71	11.26	10.81
110	20.36	19.57	18.77	17.97	17.18	16.38	16.52	16.66	16.80	16.94	17.07	16.54	16.01	15.48	14.95	14.41	13.99	13.56	13.14	12.72	12.29	11.87	11.44	11.02	10.59	10.17
120	19.15	18.40	17.66	16.91	16.17	15.42	15.54	15.65	15.77	15.88	16.00	15.50	15.01	14.51	14.01	13.52	13.12	12.72	12.32	11.92	11.52	11.12	10.72	10.32	9.92	9.52
130	17.93	17.24	16.55	15.85	15.16	14.46	14.56	14.65	14.74	14.83	14.92	14.46	14.00	13.54	13.08	12.62	12.25	11.87	11.50	11.12	10.75	10.38	10.00	9.63	9.25	8.88
140	16.72	16.08	15.43	14.79	14.15	13.51	13.57	13.64	13.71	13.78	13.85	13.42	13.00	12.57	12.15	11.72	11.37	11.03	10.68	10.33	9.98	9.63	9.28	8.93	8.59	8.24
150	15.50	14.91	14.32	13.73	13.14	12.55	12.59	12.64	12.68	12.73	12.77	12.38	11.99	11.60	11.22	10.83	10.50	10.18	9.86	9.53	9.21	8.89	8.56	8.24	7.92	7.59

Percentile:

98%	37.68
95%	34.28
90%	31.62
85%	29.31

Figure 4. Annual concentrations for stack height/property line distance combinations at the 85th, 90th, 95th, and 98th percentiles

Normalized hourly concentrations were processed in a similar way to evaluate short-term impacts.

2.3.2 Evaluation Methodology

Equations 1 and 2 below were used to calculate proposed reporting thresholds for emissions of HAP with available inhalation exposure toxicity data [2]. The normalized annual air impact values (C' in the equations) were obtained from Figure 3. Impact values at the 85^{th}, 90^{th}, 95^{th} and 98^{th} percentiles were used in calculations. These percentile impact values represent the concentrations from multiple combinations of stack heights and distances to property line that are expected to occur in conservative scenarios when one ton per year of a HAP is emitted. Unit risk factors (URF) and reference concentrations (RfC) used in the equations are based on toxicity data from the latest updates of US EPA Integrated Risk Information System [3], CalEPA Toxicity Criteria Database [4], and Agency for Toxic Substances and Disease Registry "Minimal Risk Levels for Hazardous Substances" [5]. Refer to the Department's Risk Screening Workbook for the URF and the RfC values. Using the normalized annual impacts (C') and the HAP specific URF and/or RfC, the candidate value of the reporting threshold (Q) was calculated.

Cancer based Threshold

Equation 1: $$Q = \frac{CR}{URF \times C'}$$

Non-Cancer based Threshold

Equation 2: $$Q = \frac{HQ \times RfC}{C'}$$

where:

Q = maximum annual emission rate, ton/yr – Threshold

CR = cancer risk; capped at1 x 10^{-6}

URF = pollutant-specific inhalation Unit Risk Factor, $(\mu g/m^3)^{-1}$

HQ = non-cancer risk Hazard Quotient; capped at 1

RfC = pollutant-specific Reference Concentration, $\mu g/m^3$

C' = normalized annual concentration, $(\mu g/m^3)/(ton/yr)$; for example, use the value at 95^{th} percentile.

2.3.3 Risk Guidelines for the Proposed HAP Reporting Thresholds

The cancer risk (CR) guideline for a HAP from a single source was determined as a risk of less than or equal to **one in a million (0.000001)**. The non-cancer risk guideline for a HAP was determined as a Hazard Quotient **(HQ) less than or equal to one (1)**. Risks at and below these levels are considered negligible. Cancer risk-based threshold candidate values were compared to long-term non-cancer risk threshold candidate values for those HAPs that have both carcinogenic and non-carcinogenic impacts in order to select a more stringent value. These values were also analyzed to ensure that no threshold would cause a short-term non-cancer risk with HQ above 1 if a HAP has short-term non-cancer toxicology data available.

The following principles were followed to develop the HAP reporting thresholds.

1. The maximum HAP reporting threshold is capped at 2000 pounds per year for any HAP even if the calculations by Equation 1 or 2 give a value above 2000.
2. 13 HAPs have reporting thresholds based on short-term toxicity data as these either showed a non- negligible risk for a short-term exposure when compared to long-term values or do not have long-term toxicity data available. See Appendix A for this list.
3. Certain HAPs, such as arsenic, cadmium, and chromium, are listed as "Chemical Compound Groups" (classes). These listings are defined as including any unique chemical substance that contains the named chemical (i.e., antimony, arsenic, etc.) as part of that chemical's molecular structure. When a compound or subgroup is individually listed under a group, the reporting threshold for the compound or subgroup takes precedence over the threshold listed for the chemical group. Also, no individual compound or subgroup within a chemical group should have a higher reporting threshold than its chemical group.

Table 3 shows examples of HAPs with percentile-based candidate threshold values and how a value for the reporting threshold is proposed.

Table 3. Examples of Proposed Reporting Thresholds

HAP	Percentile Based Thresholds (lbs/year)				Candidate Value for Reporting Threshold (lbs/year)
	85th	90th	95th	98th	
Benzene	8.7	8.1	7.5	6.8	**7.0**
Carbon Tetrachloride	11.4	10.5	9.7	8.8	**9.0**
Chloroform	3	2.75	2.5	2.3	**2.3**
Formaldehyde	5.3	4.9	4.5	4.1	**4.0**
Hydrogen Fluoride	955	885	816	743	**740**
Methyl Bromide	341	316	292	265	**265**
Vinyl Chloride	7.8	7.2	6.6	6.0	**6.0**
Vinyl Acetate	13647	12650	11669	10616	**2000**

2.3.4 Comparison with Current AMR VI Guidelines

The current AMR VI (1981) does not have HAP reporting thresholds. In the guideline document for this version of the regulation, however, recommended ambient concentrations were established for the HAPs. For comparison, the maximum ambient concentration for a HAP was calculated based on the new methodology described above (Section 2.3.2). For example, if a HAP has cancer Unit Risk Factor (URF) equal to 0.0000002 /(μg/m^3) and if the negligible cancer risk (CR) level is set at 0.000001 (1 in a million), the maximum annual ambient concentration of this HAP is: C = CR/URF = 0.000001 / 0.0000002 = 5 (μg/m^3).

Table 4 shows examples of how the recommended ambient concentrations in the current AMR VI guidelines are compared with the maximum concentrations based on the new methodology.

Table 4. Recommended ambient concentrations in current AMR VI (1981) guidelines compared with maximum concentrations based on new methodology

HAP	Current AMR VI - Recommended Annual Ambient Concentration		Max. Annual Concentration (μg/m3) based on new methodology -- cancer risk at 1/million & non-cancer HQ at 1
	(ppb)	(μg/m3)	
Benzene	24	76.6	0.13
Methyl Bromide	120	466	5.0
Formaldehyde	4.8	5.9	0.077
Carbon tetrachloride	12	75.6	0.17
Chloroform	24	116.8	0.043
Vinyl chloride	2.4	6.1	0.11
Chromium/compounds (VI)		0.12	0.00008

These and other comparisons indicate that the maximum HAP concentrations based on the new methodology, with the cancer risk limited at 1 in a million and the non-cancer HQ limited at 1, are much lower than the recommended ambient concentrations in the current AMR VI guidelines.

2.3.5 Comparison with New Jersey Reporting Thresholds

The methodology used here to establish the reporting thresholds is very similar to that used by the New Jersey Department of Environmental Protection to determine HAPs reporting thresholds in the New

Jersey air toxics regulation. Understandably the threshold values selected for Philadelphia are quite similar to those in the New Hersey regulation, as shown in Table 5.

Table 5. Example of Philadelphia HAP Reporting Thresholds Compared with New Jersey Thresholds

HAP	Threshold Value based on Philadelphia Scenarios (lbs/year, at 98th percentile)	New Jersey Reporting Threshold (lbs/year)
Benzene	6.8	6
Methyl bromide	265	230
Formaldehyde	4.1	3.5
Hydrogen fluoride	743	600
Carbon tetrachloride	8.8	8
Chloroform	2.3	2
Vinyl Acetate	2000	2000
Vinyl Chloride	6	5
Acetaldehyde	24	21

III. Risk Screening Workbook

The above-described methodology was also used in developing the *Risk Screening Workbook*. It is a Microsoft Excel workbook that calculates the worst-case scenario cancer and non-cancer risks based on user input data, built-in worst-case HAP concentrations derived from air quality modeling, and URF and RfC values of the HAPs. Therefore, it is an easy-to-use tool that simplifies the screening process for the permit applicant. See Section III of the *Technical Guidelines for Air Management Regulation VI* and the spreadsheet file for more information.

References:

1. US EPA HAP list: https://www.epa.gov/haps/initial-list-hazardous-air-pollutants-modifications
2. New Jersey DEP Guidance on Risk Assessment for Air Contaminant Emissions" (http://www.state.nj.us/dep/aqpp/downloads/techman/1003.pdf)
3. US EPA Integrated Risk Information System (IRIS, www.epa.gov/iris)
4. CalEPA Toxicity Criteria Database (oehha.ca.gov/tcdb/index.asp)
5. Agency for Toxic Substances and Disease Registry "Minimal Risk Levels for Hazardous Substances" (MRLs, https://www.atsdr.cdc.gov/minimalrisklevels/index.html).

Appendix A

List of Reporting Thresholds Based on Short-Term Toxicity Data

CAS #	Chemical Compound	Proposed Threshold (lbs/year)
75150	Carbon disulfide	2000
75003	Ethyl chloride	2000
111762	Ethylene glycol monobutyl ether	2000
110805	Ethylene glycol monoethyl ether (2-Ethoxy ethanol)	1800
111159	Ethylene glycol monoethyl ether acetate	685
109864	Ethylene glycol monomethyl ether (2-Methoxy ethanol)	455
7783075	Hydrogen selenide	25
	Manganese and compounds	0.8
67561	Methanol	2000
71556	Methyl chloroform	2000
108101	Methyl isobutyl ketone	2000
108883	Toluene	2000
79016	Trichloroethylene	10