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**Documentation of De minimis  
Emission Rates- Proposed  
40 CFR Part 63, Subpart B  
Background Document**

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**Emission Standards Division**

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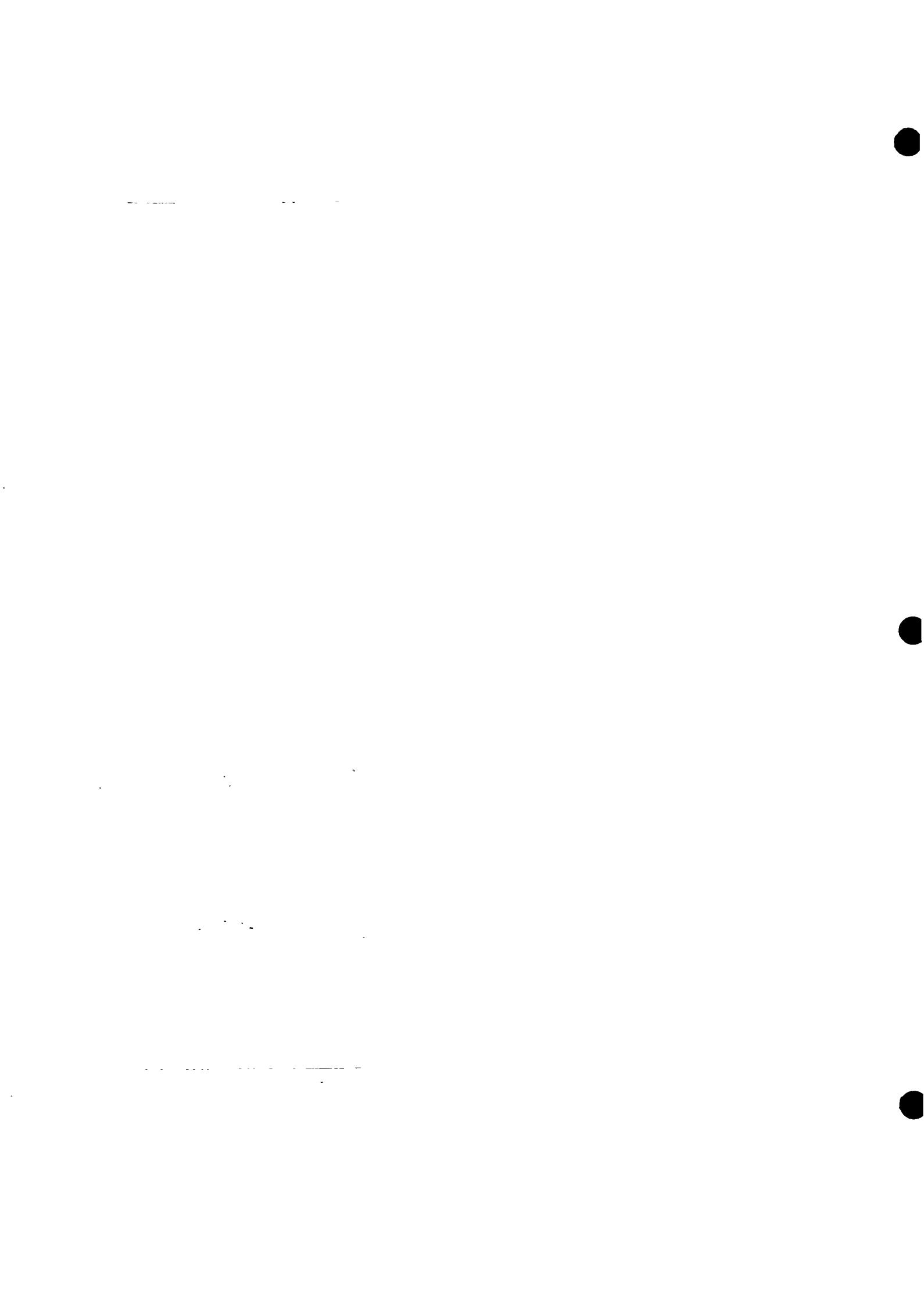
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**INTRODUCTION**

Section 112(g) of the Clean Air Act ("the Act"), as amended in 1990, requires control technology determinations for "modifications" to plant sites that are major sources of hazardous air pollutants (HAP). A "modification" is defined in section 112(a) of the Act as a physical change or change in the method of operation that causes an emission increase above de minimis levels. The EPA is proposing a rule that provides guidance for the implementation of the section 112(g) requirements, including those for "modifications." One important aspect of the proposed rule is a table (included in the proposed rule as §63.44) of de minimis emission rates. The preamble to the proposed rule discusses the overall risk management framework for the proposed de minimis levels, and discusses the types of data and analyses used by the EPA in developing them. The purpose of this document is to provide further supporting information for the de minimis emission rates, cited in the section 112(g) proposed rule, such that reviewers will be provided complete documentation of the basis for each value.

This background document contains seven sections and two appendixes. Section I contains a discussion of the risk management decisions contained in the methodology used to derive de minimis levels. Section II is a summary of the proposed de minimis levels and their basis. Section III contains a description of methods used to determine de minimis levels for "known, probable, or possible" human carcinogens while section IV

contains a parallel discussion of documents, data, and methodology used to define de minimis emission rates for effects other than cancer. De minimis levels for pollutants of "high-concern" under the Great Waters Program [section 112(m)] are discussed in section V with special case pollutants which are considered unrankable are discussed in section VI. The provisions in the proposed rule to allow States to develop programs for establishing case-by-case de minimis values are found in section VII. Appendix A contains the results of a dispersion analysis using a model plant to determine emission rates. Appendix B contains data concerning fine mineral fibers referred to in section VI.

## I. GENERAL CONSIDERATIONS IN ESTABLISHING DE MINIMIS VALUES

### A. De Minimis as a Risk Management Decision.

The statutory language contained in section 112(g) of the Act does not specifically describe the criteria for setting de minimis in the context of the modification provisions. However, the EPA believes there are general principles which have been established by the courts and by the Act that provide guidance for the establishment of de minimis emission rates.

In general, the concept of de minimis has been used by the courts for providing authority to regulatory agencies to make exceptions for regulation when the regulatory burdens of those affected by the rule would "yield a gain of trivial or no value." (For a thorough discussion of these principles, readers can

review the June 18, 1979 Alabama Power v. Costle court decision, 13 ERC 61225). The concept of de minimis, in the context of section 112(g), is intended to prevent trivial emissions increases to be considered "modifications" subject to regulation and needlessly drain administrative resources. In order to establish a de minimis emission rates under section 112(g), the EPA seeks to demonstrate levels of emission increases that would result in a trivial risk to the public health.

The EPA believes that Congress provided guidance as to what may be considered a trivial risk to human health in sections 112(c)(9) and 112(f) of the Act. Under sections 112(c)(9), source categories face no regulation and under section 112(f) residual risk is assumed to be negligible when (a) emissions of a known, probable, or possible human carcinogen could cause a lifetime risk of cancer of less than one in a million to the maximally exposed individual and (b) emissions of a non-carcinogen would not exceed a level which is adequate to protect public health with an "ample margin of safety" and would not result in adverse environmental impacts.

In establishing the de minimis emission rates, the EPA believes that where information is available to determine (1) an exposure level which results in a one-per-million cancer risk level, or (2) an exposure level which constitutes an "ample margin of safety" level, this information should serve as the basis for the de minimis levels. The risk management decisions to use these two criteria to determine de minimis emission rates

are fundamental assumptions in the methodology that follows.

For pollutants where insufficient dose-response information is available to determine the exposure level associated with either a one-per-million cancer risk or an "ample margin of safety" for noncancer effects, the proposed rule contains default values which reflect risk management decisions for establishing the de minimis emissions rates.

An important risk management decision for establishing de minimis levels under section 112(g) was to "cap" de minimis emission rates at 10 tons per year. An emission rate of any HAP of at least ten tons per year is considered a "major" amount according to the definitions in section 112(a) of the Act. The EPA believes that it would be difficult to support the designation of a "trivial" level of emissions of an air pollutant that is considered "major" by the guiding legislation.

Finally, the risk management process for establishing de minimis values for the proposed rule for section 112(g) gave consideration the interim nature of the section 112(g) requirements. It is important to note that the de minimis rates listed under section 112(g) are not intended to establish a precedent for use in other 112 programs. Specifically, the values themselves are not intended to be used as a precedent for setting residual risk standards under section 112(f) of the Act or for establishing criteria for removing source categories from the list pursuant to section 112(c)(9). However the principles involved (i.e., use of one in a million cancer risk) and some of

the supporting data (i.e., unit risks for cancer or RfCs) may be applicable to other programs wishing to determine trivial levels for regulatory purposes.

B. De Minimis Rates. Ambient Concentrations vs. Emission Rates.

The EPA considered expressing de minimis values as ambient concentrations rather than emission rates. Under this approach, the applicant would be required to determine whether an emission increase would cause an increase in ambient concentration that would exceed the de minimis level. Such an approach would require the applicant or the reviewing authority to perform a dispersion calculation for each proposed release, which would add an additional complicated step in the process. An individual dispersion analysis would not be required if the de minimis values were expressed as emission rates and based on a standard model dispersion scenario. Consistent with conclusions reached under the prevention of significant deterioration (PSD) program, the EPA believes that the added complexity of the dispersion analysis for each emission increase is not warranted. The proposed subpart B regulation does, however, provide State agencies with the option of providing for de minimis determinations based on set ambient de minimis concentrations and using a case-by-case dispersion analysis.

## II. SUMMARY OF DE MINIMIS VALUES

Section 112(b) of the Act contains a list of 189 HAP which are to be regulated under the "modification" requirements of section 112(g). This list of HAP includes 172 individual pollutants and 17 chemical groups. The 17 chemical groups are as follows: antimony compounds, arsenic compounds (inorganic including arsine), beryllium compounds, chromium compounds, cobalt compounds, coke oven emissions, cyanide compounds, glycol ethers, lead compounds, manganese compounds, mercury compounds, fine mineral fibers, nickel compounds, polycyclic organic matter, radionuclides (including radon), and selenium compounds. As discussed in the preamble to the proposed subpart B, the EPA believes that where toxicity differences exist between members in each grouping, the assignment of de minimis values should be subdivided accordingly. The documentation for subdividing the chemical groupings can be found in a technical background document for another portion of the subpart B rule ([the Draft Technical Background Document to Support Rulemaking Pursuant to the Clean Air Act Section 112\(g\). Ranking of Pollutants with Respect to Hazard to Human Health, EPA 450/3-92-010](#)).

Table 1, below, contains the individual HAP, and chemical groupings, and sub-groupings for which de minimis emission rates have been proposed for section 112(g). Sub-groupings of "radionuclides" are contained elsewhere and discussed in section six of this document (subpart B and I, and Appendix E of 40 CFR part 61). De minimis levels for fine mineral fibers are also

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Table 1

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112(g) DE MINIMIS LEVELS

CAS #	Chemical Name	DE MINIMIS LEVEL (TONS/YR)	BASIS
57147	1,1-Dimethyl hydrazine	0.008	UR
79005	1,1,2-Trichloroethane	1	UR
79345	1,1,2,2-Tetrachloroethane	0.3	UR
96128	1,2-Dibromo-3-chloropropane	0.01	UR
122667	1,2-Diphenylhydrazine	0.09	UR
106887	1,2-Epoxybutane	1	DEF=1
75558	1,2-Propylenimine (2-Methyl aziridine)	0.003	UR
120821	1,2,4-Trichlorobenzene	10	CAP-RfC
106990	1,3-Butadiene	0.07	UR
542756	1,3-Dichloropropene	1	DEF=1
1120714	1,3-Propane sulfone	0.03	UR
106467	1,4-Dichlorobenzene(p)	3	UR
123911	1,4-Dioxane (1,4-Diethyleneoxide)	6	UR
53963	2-Acetylaminofluorine	0.005	UR
532274	2-Chloroacetophenone	0.06	RfC
79469	2-Nitropropane	1	DEF=1
540841	2,2,4 - Trimethylpentane	5	DEF=5
1746016	2,3,7,8-Tetrachlorodibenzo-p-dioxin	6E-07	UR
584849	2,4 - Toluene diisocyanate	0.1	ACUTE
51285	2,4-Dinitrophenol	1	CS
121142	2,4-Dinitrotoluene	0.02	UR
94757	2,4-D, salts, esters(2,4-Dichlorophenoxy acetic acid)	10	CS
95807	2,4-Toluene diamine	0.02	UR
95954	2,4,5-Trichlorophenol	1	DEF=1
88062	2,4,6-Trichlorophenol	6	UR
91941	3,3-Dichlorobenzidene	0.2	UR
119904	3,3'-Dimethoxybenzidine	0.1	UR
119937	3,3'-Dimethyl benzidine	0.008	UR
92671	4-Aminobiphenyl	1	DEF=1
92933	4 - Nitrobiphenyl	1	DEF=1
100027	4 - Nitrophenol	5	DEF=5
101144	4,4-Methylene bis(2-chloroaniline)	0.2	UR
101779	4,4'-Methylenedianiline	1	DEF=1
534521	4,6-Dinitro-o-cresol, and salts	0.1	ACUTE
75070	Acetaldehyde	9	UR
60355	Acetamide	1	DEF=1
75058	Acetonitrile	4	RfC
98862	Acetophenone	1	CS
107028	Acrolein	0.04	RfC

CAS #	Chemical Name	DE MINIMIS LEVEL (TONS/YR)	BASIS
79061	Acrylamide	0.02	UR
79107	Acrylic acid	0.6	RfC
107131	Acrylonitrile	0.3	UR
107051	Allyl chloride	1	DEF=1
62533	Aniline	1	UR
71432	Benzene	2	UR
92875	Benzidine	0.0003	UR
98077	Benzotrichloride	0.006	UR
100447	Benzyl chloride	0.1	ACUTE
57578	beta-Propiolactone	0.1	ACUTE
92524	Biphenyl	10	CS
117817	Bis(2-ethylhexyl)phthalate (DEHP)	5	UR
542881	Bis(chloromethyl)ether	0.0003	UR
75252	Bromoform	10	CAP-UR
156627	Calcium cyanamide	10	CS
105602	Caprolactam	10	CS
133062	Captan	10	CAP-UR
63252	Carbaryl	10	CS
75150	Carbon disulfide	1	CS
56235	Carbon tetrachloride	1	UR
463581	Carbonyl sulfide	5	DEF=5
120809	Catechol	5	DEF=5
133904	Chloramben	1	DEF=1
57749	Chlordane	0.01	GWP
7782505	Chlorine	0.1	ACUTE
79118	Chloroacetic acid	0.1	ACUTE
108907	Chlorobenzene	10	CS
510156	Chlorobenzilate	0.4	UR
67663	Chloroform	0.9	UR
107302	Chloromethyl methyl ether	0.1	ACUTE
126998	Chloroprene	1	DEF=1
1319773	Cresols/Cresylic acid (isomers and mixture)	1	DEF=1
95487	o-Cresol	1	DEF=1
108394	m-Cresol	1	DEF=1
106445	p-Cresol	1	DEF=1
98828	Cumene	10	CS
334883	Diazomethane	1	DEF=1
132649	Dibenzofuran	5	DEF=5
72559	DDE (p,p'-Dichlorodiphenyldichloroethylene)	0.01	GWP
84742	Dibutylphthalate	10	CS
111444	Dichloroethyl ether (Bis(2-chloroethyl)ether)	0.06	UR
62737	Dichlorvos	0.2	UR
11422	Diethanolamine	5	DEF=5
64675	Diethyl sulfate	1	DEF=1
60117	Dimethyl aminoazobenzene	1	DEF=1
79447	Dimethyl carbamoyl chloride	0.02	UR
68122	Dimethyl formamide	1	DEF=1
131113	Dimethyl phthalate	10	CS

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## 112(g) DE MINIMIS LEVELS

CAS #	Chemical Name	DE MINIMIS LEVEL (TONS/YR)	BASIS
77781	Dimethyl sulfate	0.1	ACUTE
106898	Epichlorohydrin	2	RfC
140885	Ethyl acrylate	1	UR
100414	Ethyl benzene	10	CAP-RfC
51796	Ethyl carbamate (Urethane)	0.8	UR
75003	Ethyl chloride	10	CAP-RfC
106934	Ethylene dibromide (Dibromoethane)	0.1	UR
107062	Ethylene dichloride (1,2-Dichloroethane)	0.8	UR
107211	Ethylene glycol	10	CS
151564	Ethylene imine (Aziridine)	0.003	UR
75218	Ethylene oxide	0.1	ACUTE
96457	Ethylene thiourea	0.6	UR
75343	Ethyldene dichloride (1,1-Dichloroethane)	1	DEF=1
50000	Formaldehyde	2	UR
76448	Heptachlor	0.02	UR
118741	Hexachlorobenzene	0.01	GWP
87683	Hexachlorobutadiene	0.9	UR
77474	Hexachlorocyclopentadiene	0.1	ACUTE
67721	Hexachloroethane	5	UR
822060	Hexamethylene,-1, 6 -diisocyanate	0.02	RfC
680319	Hexamethylphosphoramide	0.01	RfC
110543	Hexane	10	CAP-RfC
302012	Hydrazine	0.004	UR
7647010	Hydrochloric acid	10	CAP-RfC
7664393	Hydrogen fluoride	0.1	ACUTE
123319	Hydroquinone	1	DEF=1
78591	Isophorone	10	CAP-UR
58899	Lindane (hexachlorcyclohexane, gamma)	0.01	GWP
108316	Maleic anhydride	1	CS
67561	Methanol	10	CS
72435	Methoxychlor	10	CS
74839	Methyl bromide (Bromomethane)	10	RfC
74873	Methyl chloride (Chloromethane)	10	CAP-UR
71556	Methyl chloroform (1,1,1-Trichloroethane)	10	CS
78933	Methyl ethyl ketone (2-Butanone)	10	CAP-RfC
60344	Methyl hydrazine	0.06	UR
74884	Methyl iodide (Iodomethane)	1	DEF=1
108101	Methyl isobutyl ketone	10	CS
624839	Methyl isocyanate	0.1	ACUTE
80626	Methyl methacrylate	10	CS
1634044	Methyl tert-butyl ether	10	CAP-RfC
12108133	Methylcyclopentadienyl manganese	0.1	ACUTE
75092	Methylene chloride (Dichloromethane)	10	CAP-UR
101688	Methylene diphenyl diisocyanate	0.1	RfC
91203	Naphthalene	10	CS
98953	Nitrobenzene	1	CS
62759	N-Nitrosodimethylamine	0.001	UR
69892	N-Nitrosomorpholine	1	DEF=1

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## 112(g) DE MINIMIS LEVELS

CAS #	Chemical Name	DE MINIMIS LEVEL (TONS/YR)	BASIS
-	Beryllium salts	0.00002	UR
-	Cadmium compounds	0.01	UR
130618	Cadmium oxide	0.01	UR
-	Chromium compounds (except Hexavalent and Trivalent)	5	DEF=5
-	Hexavalent Chromium compounds	0.002	UR
-	Trivalent Chromium compounds	5	DEF=5
10025737	Chromic chloride	0.1	ACUTE
744084	Cobalt metal (and compounds, except those specifically listed)*	0.1	CS
10210681	Cobalt carbonyl	0.1	ACUTE
62207765	Fluomine	0.1	ACUTE
-	Coke oven emissions	0.03	UR
-	Cyanide compounds (except those specifically listed)*	5	DEF=5
143339	Sodium cyanide	0.1	ACUTE
151508	Potassium cyanide	0.1	ACUTE
-	Glycol ethers (except those specifically listed)*	5	DEF=5
110805	2-Ethoxy ethanol	10	CAP-RfC
111762	Ethylene glycol monobutyl ether	10	CAP-RfC
108864	2-Methoxy ethanol	10	CAP-RfC
-	Lead and compounds (except those specifically listed )*	0.01	GWP
75741	Tetramethyl lead	0.01	GWP
78002	Tetraethyl lead	0.01	GWP
7439965	Manganese and compounds (except those specifically listed)*	0.8	RfC
12108133	Methylcyclopentadienyl manganese	0.1	ACUTE
-	Mercury compounds (except those specifically listed)*	0.01	GWP
10045940	Mercuric nitrate	0.01	GWP
748794	Mercuric chloride	0.01	GWP
62384	Phenyl mercuric acetate	0.01	GWP
-	Elemental Mercury	0.01	GWP
-	Mineral fiber compounds (except those specifically listed)*	a	-
1332214	Asbestos	a	-
-	Erionite	a	-
	Glass wool	a	-
	Rock wool	a	-
	Slag wool	a	-
-	Nickel compounds (except those specifically listed)*	1	DEF=1
13463393	Nickel Carbonyl	0.1	ACUTE
12035722	Nickel refinery dust	0.08	UR
-	Nickel subsulfide	0.04	UR
-	Polycyclic organic matter-POM (except those specifically listed)*	0.01	GWP
56553	Benz(a)anthracene	0.01	GWP
50328	Benzo(a)pyrene	0.01	UR
205992	Benzo(b)fluoranthene	0.01	GWP
57976	7,12-Dimethylbenz(a)anthracene	0.01	GWP
225514	Benz(c)acridine	0.01	GWP
218019	Chrysene	0.01	GWP
53703	Dibenz(ah)anthracene	0.01	GWP
189559	1,2:7,8-Dibenzopyrene	0.01	GWP
193395	Indeno(1,2,3-cd)pyrene	0.01	GWP

CAS #	Chemical Name	DE MINIMIS LEVEL (TONS/YR)	BASIS
684935	N-Nitroso-N-methylurea	0.0002	UR
121697	N,N-Dimethylaniline	1	CS
90040	o-Anisidine	1	DEF=1
95534	o-Toluidine	4	UR
56382	Parathion	0.1	ACUTE
82688	Pentachloronitrobenzene (Quintobenzene)	0.3	UR
87865	Pentachlorophenol	0.7	UR
108952	Phenol	0.1	CS
75445	Phosgene	0.1	ACUTE
7803512	Phosphine	5	DEF=5
7723140	Phosphorous	0.1	ACUTE
85449	Phthalic anhydride	5	DEF=5
1336363	Polychlorinated biphenyls (Aroclors)	0.009	UR
106503	p-Phenylenediamine	10	CS
123386	Propionaldehyde	5	DEF=5
114261	Propoxur (Baygone)	10	CAP-UR
78875	Propylene dichloride (1,2-Dichloropropane)	1	UR
75569	Propylene oxide	5	UR
91225	Quinoline	0.006	UR
106514	Quinone	5	DEF=5
100425	Styrene	1	DEF=1
96093	Styrene oxide	1	DEF=1
127184	Tetrachloroethylene (Perchloroethylene)	10	CAP-UR
7550450	Titanium tetrachloride	0.1	ACUTE
108883	Toluene	10	CAP-RfC
8001352	Toxaphene (chlorinated camphene)	0.01	GWP
79016	Trichloroethylene	10	CAP-UR
121448	Triethylamine	10	CAP-RfC
1582098	Trifluralin	9	UR
108054	Vinyl acetate	1	DEF=1
593602	Vinyl bromide (bromoethene)	0.6	UR
75014	Vinyl chloride	0.2	UR
75354	Vinylidene chloride (1,1-Dichloroethylene)	0.4	UR
1330207	Xylenes (isomers and mixture)	10	CS
108383	m-Xylenes	10	CS
95476	o-Xylenes	10	CS
106423	p-Xylenes	10	CS

## CHEMICAL COMPOUND CLASSES

-	Arsenic and inorganic arsenic compounds	0.005	UR
7784421	Arsine	0.005	UR
-	Antimony compounds (except those specifically listed)*	5	DEF=5
1309644	Antimony trioxide	1	DEF=1
1345046	Antimony trisulfide	0.1	CS
7783702	Antimony pentafluoride	0.1	ACUTE
28300745	Antimony potassium tartrate	1	CS
-	Beryllium compounds (except Beryllium salts)	0.008	UR

discussed in section six and Appendix B of this document. Table 1 summarizes each individual chemical or group, a proposed de minimis rate, and the basis for each determination.

### III. DOCUMENTATION OF DE MINIMIS EMISSION RATES FOR "NON-THRESHOLD" POLLUTANTS

For the proposed subpart B rule, more than half of the pollutants on the section 112(b) list of HAP are considered to be "non-threshold" pollutants. This designation is based upon available EPA and IARC (International Agency for Research on Cancer) weight-of-evidence indicating their classification as "known," "probable," or "possible" human carcinogens. Documentation for the weight-of-evidence and dose-response information for these pollutants can be obtained from the hazard ranking technical support document accompanying the section 112(g) rule (EPA/450/3-92-010).

In Table 1 of this background document, and in the Table in §63.44 of the proposed rule, the following descriptors are used in the "basis" column:

- UR
- UR-CAP
- DEF = 1

The "UR" descriptor indicates that the de minimis emission rate was calculated based upon a risk-specific dose for the pollutant. The risk-specific dose is the exposure level associated with a given lifetime cancer risk, in this case, a

risk management decision of one-per-million cancer risk. The risk-specific dose is derived from the unit risk, an upper-bound estimate of the excess cancer risk over background associated with a continuous lifetime exposure to the pollutant. Readers should be aware that there are many uncertainties associated with inferences of population risk based upon the estimate of unit risk.

For pollutants for which unit risk estimates were available, de minimis emission rates were calculated in four steps.

Step 1. Calculation of the Ambient Concentration Associated with One-per-million Cancer Risk. First, based upon the unit risk value, the EPA calculated the concentration in the ambient air that would yield a lifetime cancer risk of one-per-million. Using benzene as an example, lifetime continuous exposure to 1 microgram per cubic meter of benzene is associated with a risk which may be as high as 8.3 in one million, with a lifetime risk of one-per-million being equivalent to 0.12 micrograms per cubic meter (one divided by 8.3). As a risk management decision for the subpart B rule, unit risk estimates supported the calculation of de minimis levels under the assumption that a 70 kg human breathes 20 cubic meters of air daily.

In some cases, when inhalation unit risk values were not available, estimates for oral exposures, expressed in units of (mg/kg/day),<sup>-1</sup> were used. There are uncertainties associated with the use of data from the oral route to make inferences about inhalation route of exposure. On one hand, the use of the risk

associated with oral exposure to a HAP may be overly conservative in estimating a risk-specific dose for inhalation exposure. Such cases would occur, for example, when significant first pass effects and activating metabolism are important to the observed toxicologic effect. On the other hand, risks associated with inhalation-related portal-of-entry effects may be underestimated when based on information from oral exposure. A discussion of extrapolation of oral to inhalation values and the attendant uncertainties using such data may be found in the hazard ranking technical support document (EPA/450/3-92-010).

Documentation of each unit risk estimate used in the establishment of de minimis values for the subpart B rule can be found in Table 2. Additionally some HAP only had carcinogenic potency factors other than a unit risk available (Effective Doses for 10 percent response over background, ED<sub>10</sub>). The EPA derived unit risk estimates for such pollutants from the ED<sub>10</sub>. These estimates appear in Table 3 and are supported by a technical support document which can be found in the Docket for the proposed rule (EPA/600/R-93/199, Slope Factor Estimates For Several Hazardous Air Pollutants).

Step 2. Adjustment of risk-specific dose for duration of exposure. The second step in the calculation was to adjust the risk-specific dose to account for the expected maximum exposure period that could elapse before a major source would be subject to maximum achievable control technology (MACT) emission limitation under section 112(d) or section 112(j) of the Act.

Table 2

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## 112(g) DE MINIMIS LEVELS

CAS #	Chemical Name	WOE SOURCE	WOE CLASSIF	ORAL UR (µg/m³)	INHALAT UR (µg/m³)	SLOPE FACTOR per (mg/kg)d	UR SOURCE	RIC per (mg/m³)	COMPOSITE SCORE	COMMON UNITS-UR (µMOL/unit)	DE MINIMIS LEVEL (TONS/YR)	BASIS
117817 Bis(2-ethylhexyl)phthalate (DEHP)		IRIS	B2	4.0E-07	1.4E-02	-	IRIS IRIS IRIS	-	-	4.0E-06	5	UR
542881 Bis(chloromethyl)ether		IRIS	A	-	6.2E-02	-	-	-	-	6.2E-02	0.0003	CAP-UR
75252 Bromoform		IRIS	B2	-	1.1E-06	-	-	-	-	1.1E-06	10	CAP-UR
158627 Calcium cyanamide		-	-	-	-	-	-	-	-	16	10	CS
105602 Caprolactam		OPP MEMO	B2	1.0E-07	-	3.6E-03	OPP MEMO	-	9	1.0E-06	10	CS
133052 Capran		-	-	-	-	-	-	-	-	1.0E-06	10	CAP-UR
63252 Ceraryl		IRIS	B2	-	1.5E-05	-	IRIS	-	-	23	1	CS
75150 Carbon disulfide		IRIS	B2	-	-	-	-	-	-	1.5E-05	1	UR
56225 Carbon tetrachloride		IARC	3	-	-	-	-	-	-	-	5	DEF-S
463581 Carbonyl sulfide		EPA	WOE UR	-	-	-	-	-	-	-	5	DEF-S
120808 Catechol		IRIS	B2	-	3.7E-04	-	IRIS	-	-	3.7E-04	1	DEF-1
133904 Chloramben		-	-	-	-	-	-	-	-	-	1	GWP
57748 Chlordane		-	-	-	-	-	-	-	-	-	0.1	ACUTE
7782505 Chlorine		HEEP(84)	IRIS	B2	4.9E-06	2.3E-05	HEEP(84) IRIS	-	A	-	0.1	ACUTE
79118 Chloroacetic acid		IRIS	A	-	-	-	-	-	A	-	1	DEF-1
108907 Chlorobenzene		EPA	WOE UR	-	-	-	-	-	-	-	1	DEF-1
510158 Chlorbenzilate		IRIS	C	-	-	-	IRIS	-	-	-	1	DEF-1
67663 Chloroform		IRIS	C	-	-	-	IRIS	-	-	-	1	DEF-1
107302 Chloromethyl methyl ether		IRIS	C	-	-	-	IRIS	-	-	-	1	DEF-1
126988 Chloroprene		EPA	WOE UR	-	-	-	-	-	-	-	1	DEF-1
1319773 Cresols/Cresylic acid (isomers and mixture)		IRIS	C	-	-	-	-	-	-	-	1	DEF-1
95497 o-Cresol		IRIS	C	-	-	-	-	-	-	-	1	DEF-1
108394 m-Cresol		IRIS	C	-	-	-	-	-	-	-	1	DEF-1
106445 p-Cresol		IRIS	C	-	-	-	-	-	-	-	1	DEF-1
98828 Cumene		-	-	-	-	-	-	-	-	-	10	CS
334883 Diazomethane		IRIS	B2	9.7E-06	-	3.4E-01	IRIS	-	@7E-3	15	-	1
132649 Dibenzofuran		EPA	WOE UR	-	-	-	-	-	-	-	1	DEF-1
72559 DDE (p,p'-Dichlorodiphenyl dichloroethylene)		IRIS	B2	8.3E-06	-	2.9E-01	IRIS	-	@5E-4	-	-	1
84742 Diethyl phthalate		IRIS	B2	3.3E-04	-	-	-	-	-	-	9.7E-05	0.01
11444 Dichloroethyl ether (Bis(2-chloroethyl)ether)		IRIS	B2	9.7E-06	-	3.4E-01	IRIS	-	-	-	3.3E-04	0.06
62737 Dichlorvos		IRIS	B2	8.3E-06	-	2.9E-01	IRIS	-	-	-	6.3E-05	0.2
11422 Diethanolamine		IARC	2A	-	-	-	-	-	-	-	5	DEF-S
64675 Diethyl sulfate		IARC	RQ	B2	1.1E-03	-	ORD	-	3E-2	-	-	1
60117 Dimethyl aminocarbazolebenzene		IRIS	RQ	B2	-	-	-	-	-	-	1.1E-03	0.02
79447 Dimethyl carbamoyl chloride		IRIS	RQ	B2	-	-	-	-	-	-	1	DEF-1
68122 Dimethyl formamide		IARC	2B	-	-	-	-	-	-	-	1	DEF-1
131113 Dimethyl phthalate		IRIS	B2	-	-	-	-	-	-	-	10	CS
77781 Dimethyl sulfate		IRIS	B2	-	-	-	-	-	-	-	0.1	ACUTE
106898 Epichlorohydrin		IRIS	B2	1.2E-06	-	4.8E-02	IRIS	-	1E-3	-	2	RIC
140895 Ethyl acrylate		HEEP(87)	B2	1.4E-06	-	4.8E-02	HEEP(87)	-	-	1.2E-06	1	UR
100414 Ethyl benzene		RQ	B2	-	-	9.1E-02	-	-	1E-0	9	-	CAP-RIC
51786 Ethyl carbamate (Urethane)		RQ	B2	-	-	-	-	-	-	2.6E-05	0.8	UR
75003 Ethyl chloride		IRIS	B2	-	2.2E-04	-	IRIS	-	1E+1	-	10	CAP-RIC
106934 Ethylene dibromide (Dibromoethane)		IRIS	B2	-	2.6E-05	-	IRIS	-	@2E-4	-	0.1	UR
107062 Ethylene dichloride (1,2-Dichloroethane)		IRIS	B2	-	-	-	-	-	-	2.6E-05	0.8	UR
107211 Ethylene glycol		RQ	B2	-	-	2.5E+01	ORD	-	-	10	CS	
151564 Ethylene imine (Aziridine)		RQ	B1	-	2.3E-05	1.1E-01	OPP MEMO	IRIS	-	-	0.003	UR
75218 Ethylene oxide		OPP MEMO	B2	3.1E-06	-	-	OPP MEMO	IRIS	-	-	2.3E-05	0.1
96457 Ethylene thioate		IRIS	C	-	-	-	-	-	-	3.1E-05	0.6	UR
75343 Ethylene dichloride (1,1-Dichloroethane)		IRIS	B1	-	1.3E-05	-	-	-	-	-	1.3E-05	1
50000 Formaldehyde		IRIS	B2	-	1.3E-03	-	IRIS	-	-	-	2	UR
76448 Heptachlorobenzene		IRIS	B2	-	4.6E-04	-	IRIS	-	-	1.3E-03	0.02	GWP
118741 Hexachlorobutadiene		IRIS	C	-	2.2E-05	-	IRIS	-	-	4.6E-04	0.01	UR
87683 Hexachlorocyclopentadiene		IRIS	C	-	-	-	-	-	-	2.2E-05	0.9	ACUTE
77474 Hexachloroacyclopentadiene		IRIS	C	-	-	-	-	-	-	-	0.1	UR
67721 Hexachloroethane		IRIS	C	-	4.0E-06	-	IRIS	-	-	4.0E-06	5	UR
622060 Hexamethylene-1,6-disocyanate		IARC	28	-	-	-	-	-	-	-	0.02	RIC
680319 Hexamethylphosphoramide		IARC	28	-	-	-	-	-	-	-	0.01	RIC
110543 Hexane		IRIS	B2	-	-	-	-	-	-	-	10	CAP-RIC
302012 Hydrazine		IRIS	B2	-	4.9E-03	-	IRIS	-	-	4.9E-03	0.004	UR

### **112(g) DE MINIMS LEVELS**

## 112(g) DIE MINIMIS LEVELS

CAS #	Chemical Name	WOE SOURCE	WOE CLASSIF	ORAL UR (ug)	INHALAT UR (ug/m3)	SLOPE FACTOR per (mg/kg/d)	UR SOURCE	RIC per (mg/m3)	COMPOSITE SCORE	COMMON UNITS-UR (mill. units)	DE MINIMIS LEVEL (TONS/YR)	BASIS
<b>CHEMICAL COMPOUND CLASSES</b>												
95476	o-Xylenes	-	-	-	-	-	-	-	-	-	10	CS
106423	p-Xylenes	-	-	-	-	-	-	-	-	-	10	CS
<b>Arsenic and inorganic arsenic compounds</b>												
7784421	Arsine	IRIS	A A	-	4.3E-03	-	-	-	4.3E-3	-	0.005	UR
-	Antimony compounds (except those specifically listed)*	HEED	-	-	-	-	-	-	@5E-5	-	0.005	DEF-5
1309644	Antimony trioxide	-	B2	-	-	-	-	-	-	-	5	DEF-1
1345046	Antimony triulfide	-	-	-	-	-	-	-	-	-	1	CS
7783702	Antimony pentafluoride	-	-	-	-	-	-	-	-	-	0.1	ACUTE
28300745	Antimony potassium tetrato	-	-	-	2.4E-03	-	-	-	-	-	1	CS
-	Beryllium compounds (except Beryllium salts)	IRIS	B2	-	8.1E-01	-	IRIS	ORD	-	2.4E-03	0.008	UR
-	Cadmium compounds	IRIS	B1	-	1.8E-03	-	IRIS	IRIS	-	8.1E-01	0.00002	UR
130618	Cadmium oxide	IRIS	B1	-	1.8E-03	-	IRIS	IRIS	-	1.8E-03	0.01	UR
-	Chromium compounds (except Hexavalent and Trivalent)	-	-	-	-	-	-	-	-	-	0.01	UR
-	Hexavalent Chromium compounds	IRIS	A	-	-	-	-	-	-	-	5	DEF-5
-	Trivalent Chromium compounds	-	-	-	1.2E-02	-	-	-	-	1.2E-02	0.002	UR
10025737	Chromic chloride	-	-	-	-	-	-	-	-	-	5	DEF-5
744084	Cobalt metal (and compounds, except those specifically listed)*	-	-	-	-	-	-	-	-	-	0.1	ACUTE
10210681	Cobalt carbonyl	-	-	-	-	-	-	-	-	-	0.1	CS
62207763	Fluorine	-	-	-	-	-	-	-	-	-	0.1	ACUTE
-	Coke oven emissions	IRIS	A	-	6.2E-04	-	IRIS	-	-	6.2E-04	0.03	UR
-	Cyanide compounds (except those specifically listed)*	-	-	-	-	-	-	-	-	-	5	DEF-5
143339	Sodium cyanide	-	-	-	-	-	-	-	-	-	0.1	ACUTE
151508	Potassium cyanide	-	-	-	-	-	-	-	-	-	0.1	ACUTE
-	Glycol ethers (except those specifically listed)*	-	-	-	-	-	-	-	-	-	5	DEF-5
110805	2-Ethoxy ethanol	-	-	-	-	-	-	-	-	-	0.01	CAP-RC
111762	Ethylene glycol monobutyl ether	-	-	-	-	-	-	-	-	-	10	CAP-RC
108864	2-Methoxy ethanol	-	-	-	-	-	-	-	-	-	10	CAP-RC
-	Lead and compounds (except those specifically listed)*	IRIS	B2	-	-	-	IRIS	-	-	2E-1	@2E-2	2E-2
75741	Tetraethyl lead	-	-	-	-	-	-	-	-	15	11	
78002	Tetraethyl lead	-	-	-	-	-	-	-	-	24	24	
743965	Manganese and compounds (except those specifically listed)*	-	-	-	-	-	-	-	-	-	-	-
12108133	Methyl(cyclopentadienyl) manganese	-	-	-	-	-	-	-	-	-	-	-
-	Mercury compounds (except those specifically listed)*	-	-	-	-	-	-	-	-	-	-	-
10045940	Mercuric nitrate	-	-	-	-	-	-	-	-	-	42	-
748794	Mercuric chloride	-	-	-	-	-	-	-	-	-	40	-
62384	Phenyl mercuric acetate	-	-	-	-	-	-	-	-	-	37	-
-	Elemental Mercury	-	-	-	-	-	-	-	-	-	0.01	GWP
-	Mineral fiber compounds (except those specifically listed)*	-	-	-	-	-	-	-	-	-	0.01	GWP
1332214	Asbestos	IRIS	A	-	2.3E-01(l/ml)	-	IRIS	-	-	-	4	-
-	Erlonite	IARC	1	-	-	-	-	-	-	-	-	-
-	Glass wool	IARC	2B	-	-	-	-	-	-	-	-	-
-	Rock wool	IARC	2B	-	-	-	-	-	-	-	-	-
-	Slag wool	IARC	2B	-	-	-	-	-	-	-	-	-
-	Nickel compounds (except those specifically listed)*	-	-	-	-	-	-	-	-	-	-	-
-	Nickel subsulfide	IRIS	A	-	-	-	IRIS	IRIS	-	-	-	-
-	Poly cyclic organic matter-POCM (except those specifically listed)*	IRIS	B2	-	2.4E-04	4.8E-04	IRIS	IRIS	-	2.4E-04	0.04	UR
56553	Benz(e)anthracene	IRIS	B2	-	-	-	-	-	-	-	0.08	UR
50328	Benz(a)pyrene	IRIS	B2	-	2.1E-04	-	-	-	-	-	0.01	GWP
205992	Benz(b)fluoranthene	IRIS	B2	-	-	-	-	-	-	-	0.01	UR
517976	7,12-Dimethylbenz(a)anthracene	RQ	C	-	-	-	-	-	-	-	0.01	GWP
223514	Benz(c)acridine	RQ	B2	-	-	-	-	-	-	-	0.01	GWP
218019	Chrysene	IRIS	B2	-	-	-	-	-	-	-	0.01	GWP
533703	Dibenz(a,h)anthracene	IRIS	B2	-	-	-	-	-	-	-	0.01	GWP
189559	1,2,7,8-Dibenzopyrene	RQ	B2	-	-	-	-	-	-	-	0.01	GWP

112(g) DE MINIMS LEVELS												
CAS #	Chemical Name	WOE SOURCE	WOE CLASSIF	ORAL UR (ug/l)	INHALAT UR (ug/m <sup>3</sup> )	SLOPE FACTOR per (mg/kg)/d	UR SOURCE	RIC per (mg/m <sup>3</sup> )	COMPOSITE SCORE	COMMON UNITS-UR (Inhal. units)	DE MINIMIS LEVEL (TONSMR)	BASIS
193305	Indeno(1,2,3-c)pyrene Dioxins & Furans (TCDD equivalent) **	IRIS RAF	B2 B2	-	-	-	RAF	-	-	-	0.01	GWP
7792492	Selenium and compounds (except those specifically listed)*	IRIS	-	-	-	-	IRIS	-	-	-	**	UR
7488584	Selenium sulfide (mono and di)	IRIS	B2	-	-	-	-	-	-	-	0.1	CS
7783075	Hydrogen selenide	-	-	-	-	-	-	-	-	-	0.1	CS
10102188	Sodium selenite	-	-	-	-	-	-	-	-	-	0.1	ACUTE
13410010	Sodium selenate	-	-	-	-	-	-	-	-	-	0.1	ACUTE
88898918	Radionuclides (including radon)	Fed Reg	A	-	-	-	-	-	-	-	0.1	ACUTE

## Legend:

- UR Based on unit risk value  
 DEF-1 Used for carcinogens where no UR exists  
 RIC Based on Inhalation reference concentration listed in IRIS  
 CS composite score used where not RIC is listed in IRIS CS=1-20. De minimis =10  
 CS=21-40: De minimis=1; CS>40: De minimis=0.1  
 DEF-5 Used where no UR, RIC, or CS exists  
 CAP UR, or RIC yielded a value > 10 tons/year.  
 Thus a CAP of 10 tons/year was used.
- PENDING Awaiting data to assign a value.
- IRIS Integrated Risk Information System  
 @ A verified RIC not yet on IRIS  
 GWP Identified as a concern for persistence by the Great Waters Program  
 RQ Based on a determination for reportable quantities under CERCLA  
 EPA Preliminary assessment evaluation by Office of Health and Environmental Assessment, Human Health Assessment Group  
 HHA Health and Environmental Assessments  
 IARC International Agency for Research on Cancer  
 HEEP Health Effect and Environmental Profile  
 ORD Offices of Research and Development  
 HAD Health Assessment Documentation
- WOE UR Weight of evidence is under review, preliminary draft assessment indicates that this chemical may be considered a "nonthreshold" "hazardous air pollutant"
- Acute Identified as being of concern from short-term exposures  
 a De minimis values are zero pending public comment on the rule.  
 b The EPA relies on subpart B and I, and Appendix E of 40 CFR part 61 and assigns a de minimis level based on an effective dose equivalent of 0.3 millirem per year for a 7 year exposure period that would result in a cancer risk of one per million. The individual radionuclides subject to de minimis levels used in section 112(g) are also contained in 40 CFR part 61

## Notes:

- \* For this chemical group, specific compounds or subgroups are named specifically in this table. For the remainder of the chemicals of the chemical group, a single de minimis value is listed; this value applies to compounds which are not named specifically.
- \*\* The "toxic equivalent factor" method in EPA/625/3-89-016 U S EPA (1988) interim procedures for estimating risk associated with exposure to mixtures.
- A different de minimis level will be determined for each mixture depending on the equivalency factor used which is compound specific

**Table 3. Summary of  $Q_1^*$  and de minimis emission rates derived from ED<sub>10</sub>s.**

CAS #	HAP	$Q_1^*$ (mg/kg/day) <sup>-1</sup>	De minimis emission rates for section 112(g) (tons/yr)	** Common inhalation unit risk (micrograms /m <sup>3</sup> ) <sup>-1</sup>
75558	1,2-propylene imine	2.3E+1	0.003	6.7E-3
1120714	1,3-propane sultone	3.9E+0	0.03	7.8E-4
119904	3,3-dimethoxy- benzidine	5.2E-1	0.1	1.5E-4
121142	2,4-dinitrotoluene	3.7E-1	0.02	1.1E-4
101144	4,4'-methylene bis(2-chloraniline)	3.0E-1	0.2	8.7E-5
-	beryllium salt	8.1E-1 (microg/m <sup>3</sup> )	0.00002	8.1E-1
79447	dimethylcarbamyl chloride	1.1E-3 (microg/m <sup>3</sup> )	0.02	1.1E-3
51796	ethyl carbamate	9.1E-2	0.8	2.6E-5
151564	ethylene imine	2.5E+1	0.003	7.3E-3
75218	ethylene oxide	2.3E-5 (microg/m <sup>3</sup> )	0.1	2.3E-5
684935	N-nitroso-N-methyl urea	3.5E+2	0.0002	1.0E-1
95534	o-toluidine	2.0E-2	3	5.8E-6
53963	2- acetylaminofluorine	9.4E-1	0.005	3.9E-3
79469	2-nitropropane	-	DEF = 1	-

\*\* The expression of the  $Q_1^*$  in terms of common inhalation unit risk is intended for ease of calculation of de minimis emission rates and does not reflect a derivation of inhalation risk from oral exposure for these HAP.

The EPA selected a 7-year period as the duration of exposure, rather than the more frequently used 70-year lifetime exposure. The 7-year period was selected because sources who are subject to modification requirements under section 112(g) would be required to achieve a MACT emission rate within 7 years under sections 112(j) or 112(d). The EPA is required to promulgate MACT standards in accordance with a schedule in section 112(d) of the Act by November 15, 2000. Such standards would require compliance for existing sources by no later than the year 2003. Furthermore, if the EPA does not meet the deadlines in its schedule for promulgation section 112(d) emission standards, States are required under section 112(j) to develop equivalent emission standards within 18 months after the EPA fails to meets a deadline for promulgation of a MACT standard. As a result, the longest time for which standards would not be developed is 18 months after November 15, 2000, i.e. May 2002. Because the section 112(g) program will start up in most states in early 1995, it is judged that 2002 minus 1995, or about 7 years, is a reasonable estimate of the time that would elapse before imposition of technology requirements for emission increases which have been subject to the modification requirements of section 112(g).

Adjusting for this 7-year exposure period and using benzene as the example, a lifetime cancer risk of one-per-million is equivalent to (70/7) times 0.12 micrograms per cubic meter, or 1.2 micrograms per cubic meter.

For any known, probable, or possible human carcinogen for which a unit risk estimate is available, the risk-specific dose used for the calculation of de minimis can be calculated as follows:

$$\text{Risk-Specific dose } (\mu\text{g}/\text{m}^3) = \text{EA} \times (1 \times 10^{-6}) / \text{UR}$$

where,

$$\text{EA} = \text{exposure adjustment} = 70/7 = 10$$

$$\text{UR} = \text{Unit risk value, } (\mu\text{g}/\text{m}^3)^{-1}$$

Step 3. Development of Standard Dispersion Assumptions.

Emissions increases of HAP from a given release point, when dispersed in the atmosphere, will cause increases in ambient air concentration of those HAP according to the following equation:

$$\text{Concentration increase, } \times (\mu\text{g}/\text{m}^3) = Q \times \times/Q$$

where,

$Q$  = increase in the emission rate (typically tons/yr)

$\times/Q$  = a multiplier indicating the amount of dispersion between the release point at a specified downwind location (i.e., the amount  $\mu\text{g}/\text{m}^3$  added to the atmosphere for every tons/yr increased).

As discussed above, for purposes of proposed subpart B, the EPA decide to express the de minimis values as emission rates rather than concentrations. As a result, it became necessary to develop a standard  $\times/Q$  value that could be used. Development of this value required (a) development of a "model plant" that could be used to characterize reasonable conditions for the purposes of establishing de minimis values, and (b) performing dispersion

calculations using this model plant under a number of different sets of weather conditions.

The following set of assumptions were made for the model plant:

Worst case down-wash is assumed

Stack Height = 10 meters

Stack Diameter = 1 meter

Exit Velocity = 0.1 meters / second

Stack Temperature = 295 degrees Kelvin (ambient)

Distance to Nearest exposed individual = 200 meters

For this model plant, the EPA performed dispersion calculations using the EPA's Human Exposure Model for 314 sets of meteorological data. Each of these calculations is provided in Appendix A. The results of these calculations, which are identical to those used by the EPA for identification of high-risk pollutants in accordance with section 112(i)(5) of the Act, are contained in Appendix A. The results indicate that, using the median meteorological data, for each 5.02 micrograms per cubic meter of a pollutant added to the atmosphere at the assumed fence-line of 200 meters, there would be 10 tons of emissions. This ratio, which is equivalent to 2 tons/yr per every 1  $\mu\text{g}/\text{m}^3$  at the fence-line, was used as the standard relationship between the annual emission rate of any HAP and the ambient concentration at the fence-line for the purposes of setting de minimis emission rates for the proposed subpart B rule.

The EPA believes that the assumptions used for this dispersion analysis represent a reasonably conservative dispersion scenario for sources of HAP emissions. It is recognized that there are conditions that would result in less dispersion, and that the dispersion analysis does not represent an absolute worst-case. For example, higher ambient air concentrations could be experienced for (1) releases for which weather conditions represent the worst-case of the 314 stations, rather than the median of the 314 stations (2) releases at ground level, rather than the assumed 10 meters, and (3) releases immediately adjacent to residences, which could occur at distances less than the assumed 200 meters. The results displayed in Appendix A show that the highest concentration experienced at any one of the 314 stations was 15.6  $\mu\text{g}/\text{m}^3$ , while the lowest concentration was 2.22  $\mu\text{g}/\text{m}^3$ . The median value, therefore, could under-predict by a factor of approximately 3, or could over-predict by a factor of approximately 2. The EPA also analyzed the sensitivity of the ratio of annual emission rate to ambient fence-line concentration with regard to stack height and distance to nearest receptor. The results of this sensitivity analysis are shown in Table 4. Stack release parameters for the conditions cited in Table 4 are identical to those listed for the standard  $x/Q$  value. The results indicate that, for any given 10 tons/year release, the resulting concentration could be significantly higher than, or significantly lower, than that resulting from the selected model plant.

Table 4. Sensitivity of ambient fence-line concentration to stack height and fence-line distance for the "Model" Plant

Stack height (meters)	Distance to nearest residence (meters)	Median concentration ( $\mu\text{g}/\text{m}^3$ )
1	200	16
3	100	34
3	500	3.4
10	100	6.7
10	200	5.0 *
10	500	2.8
15	200	2.5
50	200	0.15
100	200	0.026

\* These parameters are assumed in the model plant used to calculate emission rates for the proposed rule

The EPA believes that if de minimis emission rates were based upon absolute worst-case conditions, the number of modifications subject to review would greatly increase, and that a case-by-case dispersion assessment would probably be needed in all cases to ensure that truly de minimis emission rates were not regulated. The EPA does not believe that the increased scope and complexity of the program are warranted.

Step 4. Calculation of De Minimis Emission Rate. As a fourth step, the EPA used the risk-specific dose at a one-per-million risk, identified in Step 2 above, in tandem with the standard emission rate/concentration relationship developed in Step 3, to calculate a de minimis emission rate. For example, Step 2 indicated an exposure associated with one-per-million risk of 1.2  $\mu\text{g}/\text{m}^3$  over the 7-year exposure period for benzene. In order to reach this exposure level, the model plant would need to emit  $1.2 \times 2$ , or 2.4 tons per year of benzene. For purposes of the proposed rule, each of the values is rounded to one significant figure; for benzene, 2.4 tons per year is rounded to 2 tons per year. The EPA believes that one significant figure is appropriate, given the uncertainties in the unit risk values and exposure assumptions on which the values are based.

The "UR-CAP" description in Table 1 indicates that applying the information on the risk-specific dose in tandem with the standard emission rate/concentration relationship yielded an

emissions rate greater than 10 tons per year. As indicated previously, a risk management decision was made to "cap" de minimis values at 10 tons per year.

The "DEF=1" descriptor indicates that the pollutant was assigned a default value of 1 ton/yr. This default value was assigned for "non-threshold" pollutants for which no unit risk value was available. The choice of 1 ton/yr is a policy decision based upon a review of the de minimis values for pollutants with potency values. The EPA does not believe that these pollutants should be assigned the 10 tons/year cap. An assumption is made that if potency values were available for such pollutants, they would be consistent with the distribution of de minimis values of pollutants with adequate dose-response information, and the value would likely be less than 10 tons per year.

#### IV. DOCUMENTATION OF DE MINIMIS EMISSION RATES FOR "THRESHOLD" HEALTH ENDPOINTS

In addition to the considerations for "non-threshold" pollutants discussed above, de minimis values were assigned for "threshold" health endpoints based upon concentration benchmarks representing "an ample margin of safety." For purposes of the proposed rule, the EPA has made a policy determination that the Inhalation Reference Concentration (RfC) represents an "ample margin of safety" for non-cancer effects from long term inhalation exposures.

For pollutants in which an RfC has been verified by the EPA and is listed on the Integrated Risk Information System (IRIS) data base, the de minimis emission rate was determined using the following equation:

$$Q_{dm} = 1000 \times RfC / (x/Q)$$

where:

RfC = EPA's reference concentration ( $\text{mg}/\text{m}^3$ )

$x/Q$  = relationship between emission rate ( $Q$ ) and annual average concentration ( $x$ ) for the maximum exposed individual, (micrograms per cubic meter per tons per year), 2 tons/yr per  $1 \mu\text{g}/\text{m}^3$

1000 = conversion from  $\text{mg}/\text{m}^3$  to  $\mu\text{g}/\text{m}^3$

This equation uses the same "model plant" and standard dispersion assumptions discussed previously for "non-threshold pollutants." However, the equation does not adjust for the 7-year exposure period. The RfC is designed to protect against chronic exposure for a lifetime. It is inappropriate to adjust exposure duration for a less than lifetime exposure and use the RfC as a health safety benchmark. Each RfC used for the proposed rule is indicated in Table 2.

For those pollutants with no available verified RfC, a series of default values were used to establish de minimis emission rates. The descriptor "CS" in Table 1 indicates that a Composite Score was used as the basis for a de minimis emission rate. A complete description of Composite Scores, and documentation of the Composite Scores assigned each pollutant

with the "CS" designation, can be found in the hazard ranking technical support document (EPA 450/3-92-010). Where a composite score (but no RfC) was available for a given pollutant, the default assumptions were used to assign de minimis emission rates as follows:

Range of Composite Score	<u>De minimis</u> Emission Rate
CS = 1 to 20	10 tons/year
CS = 21 - 40	1 ton/year
CS $\geq$ 41	0.1 tons/year

The selection of composite score ranges for default de minimis emission rate categories were similar to the ranges used for setting Reportable Quantities under Section 102 of the Comprehensive Environmental Response, Compensation and Liability Act (CERCLA). The above ranges coincide, respectively, with Reportable Quantities of 10, 100, and 1000 lbs. In absence of RfCs for de minimis determinations, the EPA believes that the CERCLA program provides a reasonable basis for the overall magnitude of the difference in de minimis values for section 112(g). However, the assignment of the emission rate for each default category based on Composite Score is a policy-based decision.

The descriptor PSD indicates the use of a de minimis value also used in the prevention of significant deterioration program (40 CFR 52.21). The EPA believes that it is appropriate to consider these values when available, because the section 112(g) and PSD program have similar goals in establishing "trivial" levels below which pollutants are not subject to regulation.

The descriptor "Def = 5" indicates that the HAP does not have an RfC, does not have a composite score, has not been assigned a de minimis value under the PSD program, is not classified according to EPA or IARC as a known, probable, or possible carcinogen, and is not classified as a "high-concern" pollutant under the hazard ranking. For such pollutants, a default value of 5 tons per year was assigned. This value is greater than the 1 ton per year value assigned to potential carcinogens with no potency estimate but less than the 10 ton cap. The EPA believes that the assignment of this default de minimis emission rate is a reasonable risk management decision considering the values assigned other HAP.

The descriptor "ACUTE" indicates that a risk management decision was made to assign an annual de minimis emission rate based on concern for toxicity from short-term exposures. Identification of such pollutants of concern for short-term toxicity, based upon "levels of concern" used for section 302 of SARA, Title III, is documented in the hazard ranking technical support document (EPA/450-3-92-010). For these pollutants, a default annual de minimis emission rate of 0.1 tons per year is

proposed. This de minimis value coincides with the default value assigned to pollutants of highest concern for chronic non-cancer effects.

Some HAP may produce a spectrum of health effects including cancer and non-cancer effects from long or short-term exposures. De minimis values for pollutants having multiple health concerns are proposed to be set at the lowest identified value. For example, a "non-threshold" pollutant with a de minimis emission rate of 0.1 tons/yr based on concern for short-term exposure, and a de minimis emission rate of 1 ton/yr based on a cancer risk of one-per-million, will be assigned a de minimis emission rate for purposes of the proposed rule of 0.1 tons/yr. Similarly, for pollutants for which concern for chronic exposures, based upon the RfC, yielded a value less than that for a one-per-million cancer risk, the de minimis emission rate for the proposed rule is based upon the RfC.

The EPA has asked for public comment in the proposed section 112(g) rule on an interim "default" methodology to assign short-term lb/hr de minimis emission rates for pollutants of concern for short-term exposures. Ideally, the EPA would prefer to develop hourly de minimis emission rates for acute exposure on health criteria for short-term exposure. In the future, the EPA may consider revising the de minimis emission rate table when appropriate short-term RfCs or some other appropriate health safety benchmarks are developed.

The EPA considered the following approach as an interim method to establish short-term de minimis values based upon Levels of Concern (LOCs). LOCs have been established for chemicals on the Superfund Amendments and Reauthorization Act (SARA) Title III section 302 list of "extremely hazardous substances." The LOCs indicate levels of airborne concentrations of chemicals for which no serious irreversible health effects occur following a short term exposure (30 minutes). LOCs are by definition one-tenth of "immediately Dangerous to Life and Health" levels (IDLHs) produced by NIOSH.

The EPA believes that LOCs have some possible merit for use in setting short-term de minimis values. LOCs are the only values used by the EPA which have an extensive data-base and are designed to protect from serious effects of short-term or acute exposures. LOCs are intended to protect the general population including sensitive individuals.

However, there are several disadvantages for using LOCs to set de minimis levels for such acutely toxic HAP. First, most of the LOC values are based upon animal LC50, LD50, LCLO, and LDLO data which may not protect against all health effects in humans. Second, the safety factor of 10 which is applied to IDLHs to protect sensitive individuals of the population and for protection against serious health effects may not be adequate. There are questions concerning the scientific peer review of the rationale for each LOC and supporting data. Finally, it is not known what the maximum duration of exposure at the LOC would be

for protection against adverse effects. Despite these serious disadvantages, LOCs may be appropriate as an interim basis for setting short-term de minimis levels for acutely toxic pollutants in the absence of a better methodology and supporting data.

The methodology is as follows. First, for each pollutant of concern for acute exposures, a short-term de minimis concentration for each pollutant would be derived by dividing its LOC by a safety factor of 1000. This factor of 1000 is a crude estimate of the factor needed to convert the LOC, which is based upon mortality or very severe effects, into a level that would ensure that no adverse health effects would be observed. It is a risk management decision. Second a "reasonable worst case" model plant, similar to that described above for de minimis determinations for long-term exposure, is developed to describe the relationship between the de minimis concentration and a de minimis emission rate. Again, those model plant parameters are:

Stack height is 10 meters;

Exit gas velocity is negligible;

Stack diameter is 1 meter;

Exit gas temperature is equal to the ambient temperature;

Worst-case down-wash is assumed;

The nearest exposed individual is at a distance of 200  
meters

For this model plant, the "Tier 1 screening approach" described in A Tiered Modeling Approach for Assessing the Risks Due to Hazardous Air Pollutants (EPA-450/4-92-01), is used to

describe the relationship between the de minimis concentration and a pound/hour de minimis emission rate. Use of this approach results in a ratio of maximum off-site short-term concentration to emission rate of 314 (micrograms/m<sup>3</sup>)/(lb/hr) or 0.314 (milligrams/m<sup>3</sup>)/(lb/hr). This factor indicates that the prototypical facility which emits 1 lb of pollutant in an hour will have a maximum short-term concentration off-site which will equal to 0.314 milligrams/m<sup>3</sup>.

The short-term concentration predictions made using the Tier 1 method are interpreted as 1-hour average concentrations, i.e., they account for the dilution due to the general meander of a dispersed plume over the course of a 1-hour period. Since the de minimis concentration values relate to "peak" or very short-term exposure levels (maybe on the order of a few seconds), the EPA believes it would be desirable to derive peak concentration values from the 1-hour predictions. Data taken by the EPA indicate that the concentration levels during any few second time interval within the 1-hour period will not vary more than a factor of two. Therefore, for purposes of the examples described below, a "peak-to-mean" ratio of two was used, that is, the peak concentration is assumed to be twice that of the 1-hour average.

Using the value, [(0.314 milligrams/m<sup>3</sup>)/(lb/hr)], coupled with the peak-to mean ratio of two, the de minimis emission rate ( $E_{dm}$ ), from the ambient de minimis concentration level ( $C_{dm}$ ) for each acutely toxic pollutant would be calculated as follows:

$$E_{dm} = [C_{dm}/(2)]/0.314$$

The following Table lists a number of examples illustrating the LOCs and the short-term de minimis emission rates that would result based upon this method. The EPA has asked for comment in the proposed rule on whether the final rule should incorporate these values, and on other possible alternative methods that could be used to derive short-term de minimis emission rates.

Table 5. Examples of possible short-term de minimis emission rates

CAS #	Pollutant	LOC (mg/m <sup>3</sup> )	Short- term de minimis value (lbs/hr)
107028	Acrolein	1.15	0.00183
7783702	Antimony pentafluoride	2.70	0.00430
1303282	Arsenic pentoxide	8.00	0.0127
1377533	Arsenic oxide	1.40	0.00223
7784421	Arsine	1.90	0.00302
94077	Benzotrichloride	0.700	0.00111
100447	Benzyl chloride	5.18	0.00824
57578	beta-Propiolactone	1.50	0.00239
1366190	Cadmium oxide	4.00	0.00637
7782505	Chlorine	7.25	0.0115
79118	Chloroacetic acid	1.80	0.00286
107302	Chloromethyl methyl ether	1.82	0.00290
10025737	Chromic Chloride	0.0500	0.0000795
10210681	Cobalt carbonyl	0.270	0.000430
77781	Dimethyl sulfate	5.00	0.00800
534521	4,6-Dinitro-0-cresol and salts	0.500	0.000800
151564	Ethyleneimine	4.00	0.00636

75218	Ethylene oxide	0.3ppm	-
62207765	Fluomine	3.00	0.00477
77474	Hexachlorocyclopentadiene	0.0195	0.0000310
7664393	Hydrogen fluoride	1.64	0.00261
7783075	Hydrogen selenide	0.660	0.00105
12108133	Methylcyclopentadienyl-manganese	0.600	0.000955
60344	Methyl hydrazine	0.940	0.00150
624839	Methyl isocyanate	4.70	0.00748
13463393	Nickel carbonyl	0.350	0.000557
56382	Parathion	2.00	0.00318
75445	Phosgene	0.800	0.00127
7723140	Phosphorous	3.00	0.00477
151508	Potassium cyanide	5.00	0.00796
143339	Sodium cyanide	5.00	0.00796
13410010	Sodium selenate	1.60	0.00255
10102188	Sodium selenite	2.30	0.00366
78002	Tetraethyllead	4.00	0.00637
75741	Tetramethyllead	4.00	0.00637
7550450	Titanium tetrachloride	1.00	0.00159
584849	Toluene diisocyanate	7.00	0.0111

V. CONSIDERATIONS FOR POLLUTANTS OF CONCERN UNDER EPA's 112(m)  
GREAT WATERS PROGRAM.

The descriptor "GWP" in the table of de minimis values indicates that a value of 0.01 tons per year was assigned to a "Great Waters Pollutant" for which a special de minimis value was determined as a policy decision. The EPA believes that de minimis values under section 112(g) can take into account a hazardous air pollutant's potential for causing non-air quality health and environmental impacts. For example, deposited pollutants which are persistent and bioaccumulate are of possible concern to the living resources in the ecosystem into which they are deposited. The EPA is required by section 112(m) of the Act to investigate the potential for adverse impacts of atmospheric deposition to the Great Lakes, Chesapeake Bay, Lake Champlain and Coastal Waters (collectively called the "Great Waters"). In carrying out these requirements, the following 13 HAP appear to be of the greatest concern for bioaccumulation and bioconcentration: lead and lead compounds, POM, hexachlorobenzene, mercury, PCBs, chlorinated dioxins, chlorinated furans, toxaphene, chlordane, DDE, DDT, lindane, a-hexachlorcyclohexane, and cadmium. Ref: Swain et al. Exposure and Effects of Airborne Contamination for the Great Waters Program Report. December 22, 1992.

For these pollutants, the EPA does not believe that methods are currently available to quantify the relationship between emission rates and exposures for these pollutants. Accordingly,

the EPA does not believe that a quantitative method for developing de minimis values for such HAP yet exists. The EPA believes, however, that it would be reasonable from a policy standpoint to assign relatively low values to these pollutants to address concerns for their potential to concentrate and cause adverse effects to the "Great Waters".

For the proposed rule, a policy-based "cap" of 0.01 tons per year was used as a de minimis value for such pollutants. This value represents 10 percent of the lowest de minimis value assigned to HAP based upon chronic toxicity (i.e., 10 percent of the value assigned to pollutants with a composite score greater than 40). If the de minimis value for such pollutants was based upon other considerations (described above) and yielded a value greater than 0.01 tons per year, the 0.01 tons per cap based on "Great Waters" consideration was assigned. For example, depending on the specific mercury compound involved, the health-based and default criteria yielded values of 0.1, 0.6, and 5 tons per year. For each of these mercury compounds, the proposed rule lowers the value by assigning the 0.01 tons per year "cap." On the other hand, the value for dioxin was already well below 0.01 tons per year, so the 0.01 tons per year "cap" was not the limiting consideration.

Other policy approaches were considered. One approach would be to select an alternative "cap" such as 0.1 tons per year. Another possible approach might be to lower the de minimis values to one-tenth that of the default or health-based values. For

example, under this approach elemental mercury would have a de minimis emission rate of 0.06 tons per year rather than the value which would have been assigned it based on PSD criteria.

## VI. SPECIAL CASE OF RADIONUCLIDES AND FINE MINERAL FIBERS (UNRANKABLE)

The chemical group "radionuclides" comprises a large number of different radionuclides and requires special treatment in the context of assigning appropriate de minimis values for the purposes of section 112(g). The EPA is relying on previous efforts by the Agency to evaluate cancer risks from radionuclide exposure and to provide a subcategorization of the different members of the grouping. For radionuclides, the EPA believes that an effective dose equivalent of 0.3 millirem per year for a 7 year exposure period would result in a cancer risk consistent with the one-per-million criteria used for other "non-threshold" HAP. Accordingly, this 0.3 millirem level serves as the basis for a de minimis level for section 112(g). Techniques for evaluating the level of radionuclide emissions that would result in a 0.3 millirem dose are contained in subpart B and I, and Appendix E of 40 CFR part 61.

Fine mineral fibers, as a group, also require special attention in setting de minimis levels under the proposed rule. The fine mineral group contains members which have been determined by the EPA or IARC to be at least possible human carcinogens and such pollutants are cited in Appendix B of this

document as well as the data concerning these HAP. Because size, shape, as well as chemical composition of the fibers are determinants of the toxicity of these fibers, they can not be ranked with the other "non-threshold" HAP. The same considerations make determining an appropriate de minimis levels for this grouping difficult. Therefore, the EPA will have to make a policy-based decision on what de minimis levels for this grouping will be for section 112(g) and is asking for public comment on what those levels should be in the promulgated rule. The default level is proposed to be an emission rate of zero. Although asbestos is listed separately in the Act, it is also to be treated like the fine mineral fibers grouping and data concerning its carcinogenicity is listed in Appendix B of this document.

#### VII. CASE BY CASE DE MINIMIS DETERMINATIONS

As discussed previously, the proposed rule provides for State reviewing authorities to use ambient benchmarks to develop case-by-case determination of de minimis emission rates. In this fashion, the particular dispersion characteristics of the source of the emission increase can be taken into account. However, the one in a million risk of cancer or ample margin of safety criteria for noncarcinogens reflected in the allowable fence-line ambient concentrations of HAP may not be altered. States may submit for approval the methodology for such case-by-case determinations. These programs must be reviewed by the EPA in

**accordance with section 112(l) of the Act, and regulations  
proposed as subpart E to 40 CFR Part 63.**

## **Appendix A.**

### **Dispersion Calculations for the Model Plant**

The following table indicates the results of 314 dispersion calculations using EPA's human exposure model (HEM). The following set of assumptions were used as input data for these calculations:

Worst case down-wash

Stack Height = 10 meters

Stack Diameter = 1 meter

Exit Velocity = 0.1 meters / second

Stack Temperature = 295 degrees Kelvin (ambient)

Distance to Nearest exposed individual = 200 meters

For purposes of de minimis values for the section 112(g) program, only the first and last columns in these tables are relevant. The last column (the column to the far right) indicates the meteorological station number. The first column (the column to the far left) indicates the resulting annual average concentration for the model plant for a given set of meteorological conditions, expressed in micrograms per cubic meter.

- H a n i a u -      Lifetime      Incidence      Max Risk      Conc      People      Exposure      Annual      Incidence      Interval      Repeat      Source

Canc	People	Exposure	Incidence	Max Risk	Lifetime	Canc	People	Exposure	Annual	Incidence	Interval	Repeat	Source
1. 56E+01	9	1. 43E+02	1. 43E+02	1. 34E+01	6. 93E-03	6. 93E-03	6. 93E-03	1. 34E+01	1. 56E+01	0. 005	23122	0. 005	11310
1. 34E+01	19	2. 53E+02	2. 53E+02	1. 29E+01	3. 25E-04	3. 25E-04	3. 25E-04	1. 29E+01	2. 53E+02	0. 009	24101	0. 009	24101
1. 79E+01	19	2. 44E+02	2. 44E+02	1. 29E+01	2. 66E-04	2. 66E-04	2. 66E-04	1. 29E+01	2. 44E+02	0. 011	24217	0. 011	24217
1. 19E+01	19	2. 25E+02	2. 25E+02	1. 19E+01	2. 59E-04	2. 59E-04	2. 59E-04	1. 19E+01	2. 25E+02	0. 005	14748	0. 005	14748
1. 16E+01	19	2. 20E+02	2. 20E+02	1. 16E+01	2. 59E-04	2. 59E-04	2. 59E-04	1. 16E+01	2. 20E+02	0. 007	26151	0. 007	26151
1. 07E+01	19	2. 02E+02	2. 02E+02	1. 07E+01	5. 51E-04	5. 51E-04	5. 51E-04	1. 07E+01	2. 02E+02	0. 007	26225	0. 007	26225
9. 89E+00	9	9. 04E+01	9. 04E+01	9. 89E+00	3. 32E-04	3. 32E-04	3. 32E-04	9. 89E+00	9. 04E+01	0. 006	91214	0. 006	91214
9. 74E+00	19	1. 44E+02	1. 44E+02	9. 74E+00	4. 32E-04	4. 32E-04	4. 32E-04	9. 74E+00	1. 44E+02	0. 010	14702	0. 010	14702
9. 71E+00	19	1. 44E+02	1. 44E+02	9. 71E+00	2. 84E-04	2. 84E-04	2. 84E-04	9. 71E+00	1. 44E+02	0. 006	14113	0. 006	14113
9. 10E+00	19	1. 79E+02	1. 79E+02	9. 10E+00	8. 97E-04	8. 97E-04	8. 97E-04	9. 10E+00	1. 79E+02	0. 007	20225	0. 007	20225
9. 14L+00	19	1. 79E+02	1. 79E+02	9. 14E+00	1. 38E-04	1. 38E-04	1. 38E-04	9. 14E+00	1. 79E+02	0. 007	12917	0. 007	12917
9. 12L+00	9	8. 52E+01	8. 52E+01	9. 12E+00	7. 56E-04	7. 56E-04	7. 56E-04	9. 12E+00	8. 52E+01	0. 005	23236	0. 005	23236
9. 31L+00	9	8. 51E+01	8. 51E+01	9. 31E+00	2. 31E-04	2. 31E-04	2. 31E-04	9. 31E+00	8. 51E+01	0. 007	14751	0. 007	14751
9. 06L+00	19	1. 72E+02	1. 72E+02	9. 06E+00	6. 54E-04	6. 54E-04	6. 54E-04	9. 06E+00	1. 72E+02	0. 006	13919	0. 006	13919
9. 02E+00	19	1. 71E+02	1. 71E+02	9. 02E+00	4. 29E-04	4. 29E-04	4. 29E-04	9. 02E+00	1. 71E+02	0. 007	10097	0. 007	10097
8. 92E+00	19	1. 69E+02	1. 69E+02	8. 92E+00	5. 58E-04	5. 58E-04	5. 58E-04	8. 92E+00	1. 69E+02	0. 006	14207	0. 006	14207
8. 88E+00	19	1. 68E+02	1. 68E+02	8. 88E+00	2. 90E-04	2. 90E-04	2. 90E-04	8. 88E+00	1. 68E+02	0. 007	24222	0. 007	24222
8. 78E+00	19	1. 66E+02	1. 66E+02	8. 78E+00	6. 21E-04	6. 21E-04	6. 21E-04	8. 78E+00	1. 66E+02	0. 006	13665	0. 006	13665
8. 67E+00	9	7. 93E+01	7. 93E+01	8. 67E+00	5. 07E-04	5. 07E-04	5. 07E-04	8. 67E+00	7. 93E+01	0. 008	14778	0. 008	14778
8. 56E+00	19	1. 62E+02	1. 62E+02	8. 56E+00	8. 20E-04	8. 20E-04	8. 20E-04	8. 56E+00	1. 62E+02	0. 005	13736	0. 005	13736
8. 54E+00	19	1. 62E+02	1. 62E+02	8. 54E+00	2. 21E-04	2. 21E-04	2. 21E-04	8. 54E+00	1. 62E+02	0. 009	14735	0. 009	14735
8. 39E+00	19	1. 59E+02	1. 59E+02	8. 39E+00	3. 94E-04	3. 94E-04	3. 94E-04	8. 39E+00	1. 59E+02	0. 008	24234	0. 008	24234
8. 37E+00	19	1. 58E+02	1. 58E+02	8. 37E+00	3. 77E-04	3. 77E-04	3. 77E-04	8. 37E+00	1. 58E+02	0. 007	13906	0. 007	13906
8. 35E+00	19	1. 58E+02	1. 58E+02	8. 35E+00	6. 20E-04	6. 20E-04	6. 20E-04	8. 35E+00	1. 58E+02	0. 009	14904	0. 009	14904
8. 26E+00	9	7. 55E+01	7. 55E+01	8. 26E+00	6. 37E-04	6. 37E-04	6. 37E-04	8. 26E+00	7. 55E+01	0. 007	23211	0. 007	23211
8. 22E+00	19	1. 56E+02	1. 56E+02	8. 22E+00	9. 22E-04	9. 22E-04	9. 22E-04	8. 22E+00	1. 56E+02	0. 006	13717	0. 006	13717
8. 19E+00	19	1. 55E+02	1. 55E+02	8. 19E+00	5. 94E-04	5. 94E-04	5. 94E-04	8. 19E+00	1. 55E+02	0. 008	12906	0. 008	12906
8. 19E+00	9	7. 49E+01	7. 49E+01	8. 19E+00	4. 67E-04	4. 67E-04	4. 67E-04	8. 19E+00	7. 49E+01	0. 008	23271	0. 008	23271
8. 16E+00	19	1. 54E+02	1. 54E+02	8. 16E+00	3. 79E-04	3. 79E-04	3. 79E-04	8. 16E+00	1. 54E+02	0. 010	20145	0. 010	20145
7. 99E+00	9	7. 31E+01	7. 31E+01	7. 99E+00	8. 72E-04	8. 72E-04	8. 72E-04	7. 99E+00	7. 31E+01	0. 006	14793	0. 006	14793
7. 97E+00	19	1. 51E+02	1. 51E+02	7. 97E+00	7. 10E-04	7. 10E-04	7. 10E-04	7. 97E+00	1. 51E+02	0. 007	13020	0. 007	13020
7. 91E+00	19	1. 50E+02	1. 50E+02	7. 91E+00	9. 19E-04	9. 19E-04	9. 19E-04	7. 91E+00	1. 50E+02	0. 009	13958	0. 009	13958
7. 81E+00	19	1. 48E+02	1. 48E+02	7. 84E+00	2. 97E-04	2. 97E-04	2. 97E-04	7. 84E+00	1. 48E+02	0. 015	13962	0. 015	13962
7. 83E+00	19	1. 48E+02	1. 48E+02	7. 83E+00	5. 50E-04	5. 50E-04	5. 50E-04	7. 83E+00	1. 48E+02	0. 001	21221	0. 001	21221
7. 78E+00	9	7. 12E+01	7. 12E+01	7. 70E+00	5. 69E-04	5. 69E-04	5. 69E-04	7. 70E+00	7. 12E+01	0. 007	23239	0. 007	23239
7. 75E+00	9	7. 09E+01	7. 09E+01	7. 75E+00	4. 51E-04	4. 51E-04	4. 51E-04	7. 75E+00	7. 09E+01	0. 006	14702	0. 006	14702
7. 75E+00	19	1. 47E+02	1. 47E+02	7. 75E+00	2. 79E-04	2. 79E-04	2. 79E-04	7. 75E+00	1. 47E+02	0. 009	13945	0. 009	13945
7. 69E+00	9	6. 91E+01	6. 91E+01	6. 91E+00	5. 18E-04	5. 18E-04	5. 18E-04	6. 91E+00	6. 91E+01	0. 010	14747	0. 010	14747
7. 52E+00	19	1. 42E+02	1. 42E+02	7. 52E+00	4. 32E-04	4. 32E-04	4. 32E-04	7. 52E+00	1. 42E+02	0. 008	23062	0. 008	23062
7. 50E+00	9	6. 86E+01	6. 86E+01	7. 50E+00	6. 50E-04	6. 50E-04	6. 50E-04	7. 50E+00	6. 86E+01	0. 006	23154	0. 006	23154
7. 50E+00	19	1. 42E+02	1. 42E+02	7. 50E+00	6. 20E-04	6. 20E-04	6. 20E-04	7. 50E+00	1. 42E+02	0. 007	23163	0. 007	23163

10th  
Percentile

33a

-- Humanus --  
Count People Exposure Lifetime Incidence Max Risk Conc People Exposure Annual Incidence Repeat Interval Source

1. 40E+00	19	6. 59E+01	6. 59E+01	1. 40E+00	1. 26E+03	669. 000	1. 07E+04	150.	0. 007	13744
1. 40E+00	19	6. 50E+01	6. 50E+01	1. 40E+00	1. 19E+03	669. 000	9. 70E+03	140.	0. 007	94910
1. 44E+00	19	6. 52E+01	6. 52E+01	1. 44E+00	1. 11E+03	669. 000	1. 14E+04	160.	0. 006	12960
1. 44E+00	19	6. 49E+01	6. 49E+01	1. 44E+00	7. 74E+04	669. 000	6. 54E+03	120.	0. 008	11737
1. 44E+00	19	6. 46E+01	6. 46E+01	1. 44E+00	7. 43E+04	669. 000	6. 63E+03	120.	0. 008	11753
1. 44E+00	19	6. 45E+01	6. 45E+01	1. 44E+00	1. 02E+03	669. 000	1. 01E+04	260.	0. 004	13714
1. 40E+00	9	1. 11E+01	1. 11E+01	1. 40E+00	3. 58E+04	669. 000	8. 44E+03	130.	0. 006	24137
1. 40E+00	19	6. 41E+01	6. 41E+01	1. 40E+00	2. 24E+03	669. 000	1. 66E+04	210.	0. 005	13713
1. 37E+00	19	6. 38E+01	6. 38E+01	1. 37E+00	1. 10E+03	669. 000	1. 31E+04	190.	0. 005	11840
1. 36E+00	19	6. 36E+01	6. 36E+01	1. 36E+00	7. 60E+04	669. 000	8. 61E+03	120.	0. 008	94014
1. 36E+00	19	6. 35E+01	6. 35E+01	1. 36E+00	8. 25E+04	669. 000	1. 11E+04	160.	0. 006	13970
1. 32E+00	19	6. 29E+01	6. 29E+01	1. 32E+00	8. 67E+04	669. 000	1. 19E+04	170.	0. 006	13735
1. 32E+00	19	6. 21E+01	6. 21E+01	1. 32E+00	4. 80E+04	669. 000	6. 13E+03	80.	0. 011	24012
1. 31E+00	19	6. 26E+01	6. 26E+01	1. 31E+00	1. 16E+03	669. 000	1. 48E+04	160.	0. 006	91807
1. 30E+00	19	6. 25E+01	6. 25E+01	1. 30E+00	9. 73E+04	669. 000	9. 49E+03	140.	0. 007	24023
1. 28E+00	19	6. 21E+01	6. 21E+01	1. 28E+00	9. 07E+04	669. 000	1. 24E+04	180.	0. 006	12834
1. 25E+00	19	6. 15E+01	6. 15E+01	1. 25E+00	9. 52E+04	669. 000	8. 57E+03	120.	0. 008	23049
1. 24E+00	9	2. 97E+01	2. 97E+01	1. 24E+00	1. 18E+03	669. 000	9. 73E+03	140.	0. 007	94823
1. 24E+00	9	2. 96E+01	2. 96E+01	1. 24E+00	6. 01E+04	669. 000	1. 19E+04	170.	0. 006	13701
1. 24E+00	19	6. 13E+01	6. 13E+01	1. 24E+00	3. 10E+04	669. 000	8. 07E+03	120.	0. 009	14765
1. 23E+00	9	2. 96E+01	2. 96E+01	1. 23E+00	6. 71E+04	669. 000	7. 94E+03	110.	0. 009	14825
1. 23E+00	19	6. 12E+01	6. 12E+01	1. 23E+00	5. 82E+04	669. 000	4. 84E+03	69.	0. 014	23064
1. 21E+00	19	6. 08E+01	6. 08E+01	1. 21E+00	4. 81E+04	669. 000	5. 67E+03	81.	0. 012	23047
1. 16E+00	19	5. 98E+01	5. 98E+01	1. 16E+00	1. 06E+03	669. 000	6. 69E+03	130.	0. 008	93819
1. 15E+00	19	5. 97E+01	5. 97E+01	1. 15E+00	1. 39E+03	669. 000	4. 48E+04	210.	0. 005	93026
1. 14E+00	19	5. 94E+01	5. 94E+01	1. 14E+00	1. 30E+03	669. 000	1. 15E+04	190.	0. 005	30205
1. 13E+00	19	5. 93E+01	5. 93E+01	1. 13E+00	2. 14E+03	669. 000	1. 55E+04	220.	0. 005	23185
1. 11E+00	19	5. 89E+01	5. 89E+01	1. 11E+00	7. 54E+04	669. 000	1. 19E+04	170.	0. 006	13707
1. 09E+00	9	2. 81E+01	2. 81E+01	1. 09E+00	1. 01E+03	669. 000	1. 62E+04	230.	0. 004	23170
1. 07E+00	19	5. 80E+01	5. 80E+01	1. 07E+00	9. 14E+04	669. 000	1. 11E+04	160.	0. 006	13721
1. 07E+00	19	5. 80E+01	5. 80E+01	1. 07E+00	7. 33E+04	669. 000	8. 33E+03	120.	0. 008	14607
1. 04E+00	9	2. 78E+01	2. 78E+01	1. 04E+00	4. 64E+04	669. 000	5. 76E+03	81.	0. 012	24011
1. 01E+00	19	5. 71E+01	5. 71E+01	1. 01E+00	1. 15E+03	669. 000	1. 07E+04	150.	0. 007	91824
2. 99E+00	19	5. 66E+01	5. 66E+01	2. 99E+00	1. 35E+01	669. 000	1. 26E+04	180.	0. 006	13956
2. 98E+00	19	5. 61E+01	5. 61E+01	2. 98E+00	1. 44E+03	669. 000	1. 06E+04	150.	0. 007	13881
2. 90E+00	9	2. 65E+01	2. 65E+01	2. 90E+00	8. 72E+04	669. 000	8. 75E+03	130.	0. 008	14827
2. 89E+00	19	5. 47E+01	5. 47E+01	2. 89E+00	2. 10E+03	669. 000	1. 19E+04	170.	0. 006	13895
2. 79E+00	19	5. 26E+01	5. 26E+01	2. 79E+00	5. 36E+04	669. 000	5. 58E+03	80.	0. 013	14938
2. 72E+00	19	5. 15E+01	5. 15E+01	2. 72E+00	1. 95E+03	669. 000	1. 46E+04	210.	0. 005	13850
2. 62E+00	1	2. 39E+01	2. 39E+01	2. 62E+00	3. 26E+04	669. 000	4. 74E+01	1.	0. 015	14739
2. 47E+00	19	1. 68E+01	1. 68E+01	2. 47E+00	4. 85E+04	669. 000	1. 07E+04	170.	0. 007	23044
2. 35E+00	19	1. 44E+01	1. 44E+01	2. 35E+00	1. 19E+03	669. 000	9. 65E+03	140.	0. 007	12841
2. 22E+00	1	2. 01E+01	2. 01E+01	2. 22E+00	7. 04E+04	669. 000	6. 11E+03	87.	0. 011	24015

Lifetime	Incidence	Max Risk	Conc	People	Exposure	Annual	Repeat	Interval	5 or	
1.16E+00	1.16E+01	4.16E+00	1.16E+01	6.22E+03	1.39E+03	140.	0.007	24126	13994	
4.16E+00	1.17E+01	7.87E+01	4.16E+00	6.22E+04	1.39E+03	100.	0.010	13994	13994	
4.13E+00	1.17E+01	7.82E+01	4.13E+00	1.39E+03	669.000	1.14E+04	160.	0.006	3016	13961
4.07E+00	1.19E+01	7.71E+01	4.07E+00	2.94E+04	669.000	4.33E+03	62.	0.016	0.016	13961
4.01E+00	1.19E+01	7.70E+01	4.07E+00	1.61E+04	669.000	5.77E+03	92.	0.012	0.012	9709
4.01E+00	1.19E+01	7.70E+01	4.07E+00	9.62E+04	669.000	3.45E+03	210.	0.008	12918	12918
4.06E+00	1.19E+01	7.72E+01	4.06E+00	9.88E+04	669.000	1.46E+04	210.	0.005	13807	13807
4.03E+00	1.19E+01	7.63E+01	4.03E+00	6.97E+04	669.000	1.39E+04	200.	0.005	14712	14712
4.01E+00	1.19E+01	7.60E+01	4.01E+00	5.51E+04	669.000	9.69E+03	140.	0.007	13711	13711
4.01E+00	1.19E+01	7.60E+01	4.01E+00	6.99E+04	669.000	1.50E+04	210.	0.005	4719	4719
1.01E+01	1.67L+01	1.67E+01	4.01E+00	6.99E+04	669.000	1.50E+04	160.	0.006	23155	23155
1.99E+00	1.55L+01	1.55E+01	1.99E+00	9.97E+04	669.000	1.28E+04	180.	0.005	14706	14706
1.96E+00	1.55L+01	1.55E+01	1.98E+00	4.57E+04	669.000	5.92E+03	85.	0.012	14933	14933
1.76L+00	1.62E+01	1.62E+01	1.96E+00	1.74E+04	669.000	1.69E+04	240.	0.004	93732	93732
1.96L+00	1.62E+01	1.62E+01	1.96E+00	5.50E+04	669.000	1.11E+04	160.	0.006	23155	23155
1.59E+01	1.59E+01	1.59E+01	1.92E+00	7.23E+04	669.000	6.50E+03	120.	0.008	14698	14698
1.42E+01	1.42E+01	1.42E+01	1.92E+00	1.18E+04	669.000	1.08E+04	150.	0.006	23131	23131
1.40E+00	1.40E+01	1.40E+01	1.91E+00	1.24E+04	669.000	9.73E+03	140.	0.007	3917	3917
1.91E+00	1.39E+01	1.39E+01	1.91E+00	1.06E+04	669.000	1.07E+04	150.	0.007	94745	94745
3.90E+00	1.56E+01	1.56E+01	3.90E+00	4.51E+04	669.000	1.06E+04	150.	0.007	24135	24135
3.88E+00	1.55E+01	1.55E+01	3.88E+00	1.44E+04	669.000	7.62E+03	110.	0.009	24028	24028
3.88E+00	1.54E+01	1.54E+01	3.88E+00	4.84E+04	669.000	5.55E+03	79.	0.013	14925	14925
3.87E+00	1.52E+01	1.52E+01	3.87E+00	1.25E+04	669.000	1.08E+04	150.	0.007	13976	13976
3.87E+00	1.52E+01	1.52E+01	3.87E+00	1.10E+04	669.000	1.02E+04	150.	0.007	13705	13705
3.86E+00	1.51E+01	1.51E+01	3.86E+00	1.02E+04	669.000	8.31E+03	120.	0.008	93820	93820
3.86E+00	1.50E+01	1.50E+01	3.86E+00	7.51E+04	669.000	7.11E+03	100.	0.010	23023	23023
3.84E+00	1.49E+01	1.49E+01	3.84E+00	9.49E+03	669.000	7.09E+03	100.	0.010	93034	93034
3.82E+00	1.48E+01	1.48E+01	3.82E+00	6.56E+04	669.000	1.22E+04	170.	0.006	14949	14949
3.81E+00	1.47E+01	1.47E+01	3.81E+00	4.99E+04	669.000	1.11E+04	160.	0.006	14704	14704
3.81E+00	1.46E+01	1.46E+01	3.81E+00	1.34E+04	669.000	1.70E+04	240.	0.004	13877	13877
3.80E+00	1.45E+01	1.45E+01	3.80E+00	5.08E+04	669.000	7.09E+03	100.	0.013	23065	23065
3.79E+00	1.44E+01	1.44E+01	3.82E+00	6.56E+04	669.000	1.02E+04	150.	0.006	23052	23052
3.78E+00	1.43E+01	1.43E+01	3.81E+00	4.99E+04	669.000	1.11E+04	160.	0.006	24025	24025
3.78E+00	1.42E+01	1.42E+01	3.81E+00	7.51E+04	669.000	1.70E+04	240.	0.004	14845	14845
3.77E+00	1.41E+01	1.41E+01	3.81E+00	1.34E+04	669.000	5.35E+03	76.	0.007	13961	13961
3.76E+00	1.40E+01	1.40E+01	3.80E+00	4.17E+04	669.000	1.22E+04	170.	0.005	23052	23052
3.75E+00	1.39E+01	1.39E+01	3.82E+00	6.56E+04	669.000	1.32E+04	190.	0.010	0.010	14922
3.75E+00	1.38E+01	1.38E+01	3.81E+00	4.99E+04	669.000	6.80E+03	97.	0.007	93841	93841
3.74E+00	1.37E+01	1.37E+01	3.81E+00	7.75E+04	669.000	9.65E+03	140.	0.007	14947	14947
3.66E+00	1.36E+01	1.36E+01	3.66E+00	8.43E+04	669.000	1.06E+04	150.	0.006	93841	93841
3.65E+00	1.35E+01	1.35E+01	3.66E+00	1.39E+04	669.000	1.19E+04	170.	0.006	14944	14944
3.59E+00	1.32E+01	1.32E+01	3.59E+00	9.71E+04	669.000	8.02E+03	110.	0.009	3072	3072
3.58E+00	1.30E+01	1.30E+01	3.58E+00	7.22E+04	669.000	8.26E+03	120.	0.006	0.006	14847
3.58E+00	1.29E+01	1.29E+01	3.58E+00	1.10E+04	669.000	1.09E+04	160.	0.006	93817	93817
3.57E+00	1.28E+01	1.28E+01	3.57E+00	6.77E+04	669.000	7.91E+03	110.	0.003	14941	14941
3.55E+00	1.27E+01	1.27E+01	3.55E+00	5.24E+04	669.000	1.09E+04	150.	0.006	93847	93847
3.52E+00	1.26E+01	1.26E+01	3.52E+00	9.71E+04	669.000	8.01E+03	130.	0.008	14849	14849
3.52E+00	1.25E+01	1.25E+01	3.52E+00	7.22E+04	669.000	8.26E+03	120.	0.006	0.006	14847
3.50L+00	1.24E+01	1.24E+01	3.50L+00	1.10E+04	669.000	1.09E+04	160.	0.006	93817	93817
3.50L+00	1.23E+01	1.23E+01	3.50L+00	6.75E+04	669.000	7.91E+03	110.	0.003	14941	14941
3.50L+00	1.22E+01	1.22E+01	3.50L+00	5.24E+04	669.000	1.09E+04	150.	0.006	93847	93847
3.50L+00	1.21E+01	1.21E+01	3.50L+00	9.71E+04	669.000	8.01E+03	130.	0.008	14849	14849
3.50L+00	1.20E+01	1.20E+01	3.50L+00	7.22E+04	669.000	8.26E+03	120.	0.006	0.006	14847
3.50L+00	1.19E+01	1.19E+01	3.50L+00	1.10E+04	669.000	1.09E+04	160.	0.006	93817	93817
3.50L+00	1.18E+01	1.18E+01	3.50L+00	6.75E+04	669.000	7.91E+03	110.	0.003	14941	14941
3.50L+00	1.17E+01	1.17E+01	3.50L+00	5.24E+04	669.000	1.09E+04	150.	0.006	93847	93847
3.50L+00	1.16E+01	1.16E+01	3.50L+00	9.71E+04	669.000	8.01E+03	130.	0.008	14849	14849
3.50L+00	1.15E+01	1.15E+01	3.50L+00	7.22E+04	669.000	8.26E+03	120.	0.006	0.006	14847
3.50L+00	1.14E+01	1.14E+01	3.50L+00	1.10E+04	669.000	1.09E+04	160.	0.006	93817	93817

- H a n i n g -		Lifetime Max Risk		Conc	People	Exposure	Incidence	Annual Incidence	Repeat Interval	Sources
4.63E+00	1.9	8.76E+01	8.76E+01	4.63E+00	4.63E+01	4.63E+01	3.03E-04	669.000	8.98E+03	130.
4.62E+00	1.9	8.74E+01	8.74E+01	4.62E+00	4.62E+01	4.62E+01	3.02E-04	669.000	8.95E+03	120.
4.61E+00	1.9	8.73E+01	8.73E+01	4.61E+00	4.61E+01	4.61E+01	3.01E-04	669.000	1.34E+04	110.
4.60E+00	1.9	4.20E+01	4.20E+01	4.60E+00	4.60E+01	4.60E+01	5.71E-04	669.000	1.20E+04	100.
4.58E+00	1.9	4.19E+01	4.19E+01	4.58E+00	4.58E+01	4.58E+01	5.72E-04	669.000	7.45E+03	110.
4.58E+00	1.9	8.66E+01	8.66E+01	4.58E+00	4.58E+01	4.58E+01	3.17E-04	669.000	4.75E+03	60.
4.56E+00	1.9	4.17E+01	4.17E+01	4.56E+00	4.56E+01	4.56E+01	3.34E-04	669.000	8.19E+03	120.
4.55E+00	1.9	8.60E+01	8.60E+01	4.55E+00	4.55E+01	4.55E+01	6.96E-04	669.000	6.65E+03	95.
4.54E+00	1.9	8.60E+01	8.60E+01	4.54E+00	4.54E+01	4.54E+01	3.60E-04	669.000	6.36E+03	90.
4.52E+00	1.9	8.56E+01	8.56E+01	4.52E+00	4.52E+01	4.52E+01	7.07E-04	669.000	7.80E+03	110.
4.52E+00	1.9	4.11E+01	4.11E+01	4.52E+00	4.13E+01	4.13E+01	5.91E-04	669.000	1.03E+04	150.
4.50E+00	1.9	8.51E+01	8.51E+01	4.50E+00	4.51E+01	4.51E+01	7.06E-04	669.000	1.00E+04	140.
4.49E+00	1.9	8.50E+01	8.50E+01	4.49E+00	4.49E+01	4.49E+01	6.21E-04	669.000	7.44E+03	110.
4.46E+00	1.9	8.45E+01	8.45E+01	4.46E+00	4.46E+01	4.46E+01	7.38E-04	669.000	6.46E+03	92.
4.46E+00	1.9	8.44E+01	8.44E+01	4.46E+00	4.46E+01	4.46E+01	6.75E-04	669.000	7.23E+03	100.
4.46E+00	1.9	8.44E+01	8.44E+01	4.46E+00	4.46E+01	4.46E+01	4.50E-04	669.000	7.68E+03	110.
4.44E+00	1.9	4.06E+01	4.06E+01	4.44E+00	4.06E+01	4.06E+01	7.69E-04	669.000	1.30E+04	120.
4.41E+00	1.9	4.04E+01	4.04E+01	4.41E+00	4.04E+01	4.04E+01	4.04E+00	6.30E+03	110.	
4.41E+00	1.9	8.35E+01	8.35E+01	4.41E+00	4.35E+01	4.35E+01	4.41E+00	6.36E+03	110.	
4.40E+00	1.9	8.32E+01	8.32E+01	4.40E+00	4.32E+01	4.32E+01	1.27E+01	669.000	1.29E+04	110.
4.39E+00	1.9	4.01E+01	4.01E+01	4.39E+00	4.01E+01	4.01E+01	5.41E-04	669.000	6.35E+03	91.
4.39E+00	1.9	8.30E+01	8.30E+01	4.39E+00	4.30E+01	4.30E+01	6.32E-04	669.000	7.03E+03	110.
4.38E+00	1.9	8.29E+01	8.29E+01	4.38E+00	4.29E+01	4.29E+01	7.36E-04	669.000	1.15E+04	160.
4.38E+00	1.9	8.29E+01	8.29E+01	4.38E+00	4.29E+01	4.29E+01	6.12E-04	669.000	7.23E+03	100.
4.36E+00	1.9	8.25E+01	8.25E+01	4.36E+00	4.25E+01	4.25E+01	2.14E-04	669.000	6.65E+03	95.
4.36E+00	1.9	8.25E+01	8.25E+01	4.36E+00	4.25E+01	4.25E+01	1.44E-03	669.000	1.25E+04	100.
4.34E+00	1.9	8.21E+01	8.21E+01	4.34E+00	4.21E+01	4.21E+01	4.34E-04	669.000	5.68E+03	81.
4.34E+00	1.9	3.97E+01	3.97E+01	4.34E+00	3.97E+01	3.97E+01	4.84E-04	669.000	6.86E+03	90.
4.33E+00	1.9	3.96E+01	3.96E+01	4.33E+00	3.96E+01	3.96E+01	5.50E-04	669.000	1.30E+04	110.
4.33E+00	1.9	8.13E+01	8.13E+01	4.33E+00	4.30E+01	4.30E+01	1.12E-03	669.000	1.01E+04	110.
4.29E+00	1.9	8.13E+01	8.13E+01	4.29E+00	4.13E+01	4.13E+01	4.34E-04	669.000	8.13E+03	120.
4.28E+00	1.9	8.11E+01	8.11E+01	4.28E+00	4.11E+01	4.11E+01	4.28E-04	669.000	1.32E+04	110.
4.28E+00	1.9	8.10E+01	8.10E+01	4.28E+00	4.10E+01	4.10E+01	7.22E-04	669.000	1.21E+04	170.
4.28E+00	1.9	8.10E+01	8.10E+01	4.28E+00	4.10E+01	4.10E+01	5.77E-04	669.000	9.03E+03	130.
4.26E+00	1.9	8.06E+01	8.06E+01	4.26E+00	4.06E+01	4.06E+01	5.26E-04	669.000	7.50E+03	110.
4.25E+00	1.9	8.05E+01	8.05E+01	4.25E+00	4.05E+01	4.05E+01	6.92E-04	669.000	9.55E+03	140.
4.24E+00	1.9	8.03E+01	8.03E+01	4.24E+00	4.03E+01	4.03E+01	4.24E-04	669.000	1.53E+04	220.
4.23E+00	1.9	8.01E+01	8.01E+01	4.23E+00	4.01E+01	4.01E+01	6.34E-04	669.000	7.69E+03	110.
4.23E+00	1.9	8.01E+01	8.01E+01	4.23E+00	4.23E+01	4.23E+01	3.22E-04	669.000	1.33E+04	190.
4.22E+00	1.9	3.86E+01	3.86E+01	4.22E+00	3.86E+01	3.86E+01	1.11E-03	669.000	9.82E+03	140.
4.20E+00	1.9	3.84E+01	3.84E+01	4.20E+00	3.84E+01	3.84E+01	4.20E+00	669.000	1.51E+04	220.
4.17E+00	1.9	7.90E+01	7.90E+01	4.17E+00	7.90E+01	7.90E+01	3.74E-04	669.000	7.53E+03	110.
4.16E+00	1.9	7.88E+01	7.88E+01	4.16E+00	7.88E+01	7.88E+01	4.16E+00	669.000	1.06E+04	150.
4.16E+00	1.9	7.88E+01	7.88E+01	4.16E+00	7.88E+01	7.88E+01	4.16E+00	669.000	1.06E+04	150.

## - Humanus -

## - Lifetime

Conc People Exposure

Incidence Max Risk

Annual Incidence

Repeat Interval

Source

Conc	People	Exposure	Lifetime Incidence	Max Risk	Conc	People	Exposure	Annual Incidence	Repeat Interval	Source
5.11E+00	19	1.01E+02	1.01E+02	5.33E+00	4.07E-04	669,000	7.94E+03	94798	0.009	94798
5.12E+00	9	4.07E+01	4.07E+01	5.32E+00	4.37E-04	669,000	1.32E+04	190,	0.003	26130
5.12E+00	9	4.07E+01	4.07E+01	5.32E+00	3.97E-04	669,000	1.35E+04	190,	0.003	26130
5.30E+00	19	1.00E+02	1.00E+02	5.30E+00	4.01E-04	669,000	6.37E+03	91,	0.011	3113
5.28E+00	19	9.99E+01	9.99E+01	5.28E+00	6.77E-04	669,000	1.74E+04	250,	0.004	11071
5.27E+00	19	9.98E+01	9.98E+01	5.27E+00	3.11E-04	669,000	7.19E+03	100,	0.010	26118
5.25E+00	9	4.00E+01	4.00E+01	5.25E+00	8.13E-04	669,000	1.19E+04	170,	0.005	24230
5.25E+00	19	9.94E+01	9.94E+01	5.25E+00	4.91E-04	669,000	7.39E+03	110,	0.009	26156
5.21E+00	19	9.90E+01	9.90E+01	5.23E+00	4.46E-04	669,000	1.07E+04	150,	0.007	13734
5.21E+00	19	9.90E+01	9.90E+01	5.23E+00	6.14E-04	669,000	5.51E+03	79,	0.013	16914
5.22E+00	19	9.88E+01	9.88E+01	5.22E+00	1.07E-03	669,000	1.33E+04	190,	0.005	93112
5.22E+00	19	9.87E+01	9.87E+01	5.22E+00	6.88E-04	669,000	9.29E+03	130,	0.008	13941
5.21E+00	19	9.87E+01	9.87E+01	5.21E+00	4.86E-04	669,000	6.49E+03	93,	0.011	14021
5.20E+00	19	9.84E+01	9.84E+01	5.20E+00	6.96E-04	669,000	1.46E+04	210,	0.005	11728
5.19E+00	19	9.82E+01	9.82E+01	5.19E+00	2.73E-04	669,000	7.89E+03	110,	0.009	14043
5.16E+00	19	9.76E+01	9.76E+01	5.16E+00	5.91E-04	669,000	5.91E+03	85,	0.012	91822
5.15E+00	19	9.75E+01	9.75E+01	5.15E+00	1.07E-03	669,000	1.13E+04	160,	0.006	13870
5.10E+00	19	9.66E+01	9.66E+01	5.10E+00	6.98E-04	669,000	7.36E+03	110,	0.019	14942
5.10E+00	9	4.66E+01	4.66E+01	5.10E+00	1.60E-04	669,000	1.20E+04	100,	0.003	93057
5.08E+00	9	4.62E+01	4.62E+01	5.08E+00	1.14E-03	669,000	1.27E+04	100,	0.006	24153
5.08E+00	19	2.51E+01	2.51E+01	5.09E+00	5.15E-04	669,000	1.98E+04	210,	0.005	11732
5.02E+00	19	9.50E+01	9.50E+01	5.02E+00	7.89E-04	669,000	2.98E+03	110,	0.001	22150
5.02E+00	19	9.49E+01	9.49E+01	5.01E+00	5.29E-04	669,000	9.04E+03	120,	0.001	24131
5.01E+00	19	9.43E+01	9.43E+01	5.01E+00	6.01E-04	669,000	1.05E+04	150,	0.007	13957
4.98E+00	19	9.42E+01	9.42E+01	4.98E+00	6.98E-04	669,000	9.25E+03	130,	0.006	23069
4.98E+00	19	9.42E+01	9.42E+01	4.98E+00	2.75E-04	669,000	7.56E+03	110,	0.009	11074
4.91E+00	9	4.51E+01	4.51E+01	4.93E+00	1.63E-04	669,000	6.94E+03	130,	0.008	14717
4.92E+00	19	9.32E+01	9.32E+01	4.92E+00	8.32E-04	669,000	1.33E+04	190,	0.005	24106
4.92E+00	19	9.31E+01	9.31E+01	4.92E+00	7.52E-04	669,000	1.19E+04	130,	0.008	21034
4.90E+00	9	4.48E+01	4.48E+01	4.90E+00	6.86E-04	669,000	9.06E+03	120,	0.003	3022
4.89E+00	9	4.47E+01	4.47E+01	4.89E+00	1.16E-03	669,000	1.03E+04	150,	0.007	3013
4.85E+00	19	9.18E+01	9.18E+01	4.85E+00	1.05E-03	669,000	1.58E+04	230,	0.004	93162
4.82E+00	19	9.13E+01	9.13E+01	4.82E+00	1.02E-03	669,000	1.45E+04	210,	0.005	23129
4.81E+00	19	9.11E+01	9.11E+01	4.81E+00	1.21E-03	669,000	1.36E+04	190,	0.005	11025
4.81E+00	19	9.10E+01	9.10E+01	4.81E+00	2.42E-04	669,000	2.29E+03	110,	0.001	94224
4.79E+00	19	9.07E+01	9.07E+01	4.79E+00	3.34E-04	669,000	6.25E+03	89,	0.011	14940
4.79E+00	9	4.30E+01	4.30E+01	4.80E+00	1.05E-03	669,000	1.58E+04	230,	0.004	93162
4.78E+00	19	9.05E+01	9.05E+01	4.78E+00	1.02E-03	669,000	1.45E+04	210,	0.005	24155
4.77E+00	19	9.03E+01	9.03E+01	4.77E+00	1.21E-03	669,000	1.36E+04	190,	0.005	11025
4.76E+00	19	9.01E+01	9.01E+01	4.76E+00	2.42E-04	669,000	2.29E+03	110,	0.001	94224
4.75E+00	19	9.00E+01	9.00E+01	4.75E+00	3.33E-04	669,000	6.25E+03	89,	0.011	14940
4.75E+00	19	8.91E+01	8.91E+01	4.75E+00	1.05E-03	669,000	1.58E+04	230,	0.004	93162
4.65E+00	19	8.91E+01	8.91E+01	4.65E+00	1.04E-03	669,000	1.45E+04	200,	0.005	23179
4.65E+00	19	8.90E+01	8.90E+01	4.65E+00	1.16E-03	669,000	1.67E+03	120,	0.008	13996
4.65E+00	19	8.89E+01	8.89E+01	4.65E+00	0.19E-04	669,000	1.29E+04	100,	0.005	13866
4.65E+00	19	8.79E+01	8.79E+01	4.65E+00	7.13E-04	669,000	1.27E+04	150,	0.007	13748
4.64E+00	19	8.79E+01	8.79E+01	4.64E+00	8.32E-04	669,000	1.02E+04	150,	0.007	12642

Percentile (Median)

50th

-- Human Health		Lifetime Risk		Incidence		Annual Incidence		Exposure		People		Conc		-- Human Resource			
	Conc	People	Exposure	Lifetime	Incidence	Max Risk	Conc	Conc	Conc	Repeat	Incidence	Exposure	People	Conc	Conc	Conc	Interval
	6.14E+00	9	5.62E+01	6.14E+00	6.14E+00	6.14E+00	6.14E+00	6.14E+00	6.14E+00	0.007	150.	669,000	1.02E+04	100.	6.14E+00	6.14E+00	23220
	6.13E+00	19	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	0.006	13915	669,000	1.25E+04	100.	6.13E+00	6.13E+00	13915
	6.12E+00	19	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	0.012	14020	669,000	6.07E+03	97.	6.12E+00	6.12E+00	14020
70th Percentile	6.11E+00	19	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	0.007	14750	669,000	9.79E+03	140.	6.11E+00	6.11E+00	14750
	6.10E+00	19	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	1.16E+02	0.006	14240	669,000	1.16E+04	170.	6.10E+00	6.10E+00	14240
	6.09E+00	19	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02	0.006	24241	669,000	1.23E+04	100.	6.09E+00	6.09E+00	24241
	6.08E+00	19	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02	1.15E+02	0.018	12917	669,000	7.10E+03	100.	6.08E+00	6.08E+00	12917
	6.08E+00	9	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01	5.56E+01	0.009	94746	669,000	7.74E+03	110.	6.08E+00	6.08E+00	94746
	6.02E+00	19	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	0.009	13743	669,000	8.15E+03	120.	6.02E+00	6.02E+00	13743
	6.00E+00	19	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	0.004	31106	669,000	1.67E+04	240.	6.00E+00	6.00E+00	31106
	6.00E+00	19	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	1.14E+02	0.010	11972	669,000	6.92E+03	99.	6.00E+00	6.00E+00	11972
5.94E+00	19	5.45E+01	5.45E+01	5.45E+01	5.45E+01	5.45E+01	5.45E+01	5.45E+01	0.007	24220	669,000	1.05E+04	150.	5.94E+00	5.94E+00	24220	
	5.90E+00	9	5.30E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01	0.005	31244	669,000	1.44E+04	210.	5.90E+00	5.90E+00	31244
	5.88E+00	19	5.11E+02	5.11E+02	5.11E+02	5.11E+02	5.11E+02	5.11E+02	5.11E+02	0.007	24241	669,000	1.04E+04	150.	5.88E+00	5.88E+00	24241
	5.87E+00	9	5.16E+01	5.16E+01	5.16E+01	5.16E+01	5.16E+01	5.16E+01	5.16E+01	0.006	23168	669,000	1.09E+04	160.	5.87E+00	5.87E+00	23168
	5.81E+00	19	5.11E+02	5.11E+02	5.11E+02	5.11E+02	5.11E+02	5.11E+02	5.11E+02	0.006	14622	669,000	1.08E+04	150.	5.81E+00	5.81E+00	14622
	5.81E+00	9	5.33E+01	5.33E+01	5.33E+01	5.33E+01	5.33E+01	5.33E+01	5.33E+01	0.007	24220	669,000	1.01E+04	140.	5.81E+00	5.81E+00	24220
	5.82E+00	19	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	0.003	31106	669,000	8.04E+03	139.	5.82E+00	5.82E+00	31106
	5.82E+00	19	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	0.007	94746	669,000	1.06E+04	150.	5.82E+00	5.82E+00	94746
	5.82E+00	19	5.02E+01	5.02E+01	5.02E+01	5.02E+01	5.02E+01	5.02E+01	5.02E+01	0.005	94725	669,000	1.06E+04	190.	5.82E+00	5.82E+00	94725
	5.80E+00	19	5.02E+01	5.02E+01	5.02E+01	5.02E+01	5.02E+01	5.02E+01	5.02E+01	0.005	23168	669,000	1.06E+04	190.	5.80E+00	5.80E+00	23168
	5.79E+00	19	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	0.006	14622	669,000	1.32E+04	190.	5.79E+00	5.79E+00	14622
	5.79E+00	9	5.30E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01	5.30E+01	0.005	24220	669,000	1.15E+04	160.	5.79E+00	5.79E+00	24220
	5.79E+00	19	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	0.005	31106	669,000	1.43E+04	200.	5.79E+00	5.79E+00	31106
	5.79E+00	9	5.11E+02	5.11E+02	5.11E+02	5.11E+02	5.11E+02	5.11E+02	5.11E+02	0.005	14745	669,000	1.33E+04	190.	5.79E+00	5.79E+00	14745
	5.79E+00	19	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	5.10E+02	0.011	14931	669,000	6.28E+03	90.	5.79E+00	5.79E+00	14931
	5.77E+00	19	5.09E+02	5.09E+02	5.09E+02	5.09E+02	5.09E+02	5.09E+02	5.09E+02	0.008	31106	669,000	8.08E+03	130.	5.77E+00	5.77E+00	31106
	5.67E+00	9	5.19E+01	5.19E+01	5.19E+01	5.19E+01	5.19E+01	5.19E+01	5.19E+01	0.005	23245	669,000	1.46E+04	210.	5.67E+00	5.67E+00	23245
	5.66E+00	19	5.07E+02	5.07E+02	5.07E+02	5.07E+02	5.07E+02	5.07E+02	5.07E+02	0.005	14960	669,000	5.54E+03	79.	5.66E+00	5.66E+00	14960
	5.63E+00	9	5.15E+01	5.15E+01	5.15E+01	5.15E+01	5.15E+01	5.15E+01	5.15E+01	0.005	94794	669,000	7.23E+03	100.	5.63E+00	5.63E+00	94794
	5.62E+00	19	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	0.004	23275	669,000	1.60E+04	230.	5.62E+00	5.62E+00	23275
	5.62E+00	19	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	0.010	24127	669,000	7.26E+03	100.	5.62E+00	5.62E+00	24127
	5.60E+00	19	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	0.010	14960	669,000	6.05E+03	90.	5.60E+00	5.60E+00	14960
	5.59E+00	19	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	5.06E+02	0.006	14921	669,000	1.10E+04	160.	5.59E+00	5.59E+00	14921
	5.58E+00	19	5.05E+02	5.05E+02	5.05E+02	5.05E+02	5.05E+02	5.05E+02	5.05E+02	0.006	14740	669,000	7.77E+03	130.	5.58E+00	5.58E+00	14740
	5.54E+00	19	5.05E+02	5.05E+02	5.05E+02	5.05E+02	5.05E+02	5.05E+02	5.05E+02	0.012	14933	669,000	1.11E+04	160.	5.54E+00	5.54E+00	14933
	5.54E+00	19	5.05E+02	5.05E+02	5.05E+02	5.05E+02	5.05E+02	5.05E+02	5.05E+02	0.012	14926	669,000	5.85E+03	85.	5.54E+00	5.54E+00	14926
60th Percentile	5.51E+00	19	5.02E+01	5.02E+01	5.02E+01	5.02E+01	5.02E+01	5.02E+01	5.02E+01	0.009	94225	669,000	7.45E+03	110.	5.51E+00	5.51E+00	94225
	5.52E+00	19	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	0.006	14902	669,000	1.23E+04	180.	5.52E+00	5.52E+00	14902
	5.44E+00	19	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	0.007	14736	669,000	9.68E+03	140.	5.44E+00	5.44E+00	14736
	5.42E+00	19	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	0.007	13873	669,000	1.05E+04	150.	5.42E+00	5.42E+00	13873
	5.41E+00	19	5.02E+02	5.02E+02	5.02E+02	5.02E+02	5.02E+02	5.02E+02	5.02E+02	0.007	14752	669,000	1.07E+04	150.	5.41E+00	5.41E+00	14752
	5.41E+00	19	5.02E+02	5.02E+02	5.02E+02	5.02E+02	5.02E+02	5.02E+02	5.02E+02	0.009	13908	669,000	8.17E+03	120.	5.41E+00	5.41E+00	13908
	5.36E+00	19	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	5.01E+02	0.006	14806	669,000	6.63E+03	120.	5.36E+00	5.36E+00	14806

- Max - Min - Lifetime Incidence Max Risk

Conc	People	Exposure	Conc	People	Exposure	Annual Incidence	Repeat Interval	Sources
7.46E+00	19	1.41E+02	7.46E+00	7.45E+02	1.41E+02	7.45E+00	7.46E+00	3.92E+01
7.45E+00	19	1.41E+02	7.45E+00	7.45E+02	1.40E+02	7.45E+00	7.45E+00	3.90E+01
7.38E+00	19	1.40E+02	7.38E+00	7.38E+02	1.39E+02	7.38E+00	7.38E+00	3.88E+01
7.34E+00	9	6.71E+01	7.34E+00	6.71E+01	6.71E+01	7.34E+00	7.34E+00	3.84E+01
7.30E+00	19	1.38E+02	7.30E+00	1.38E+02	1.38E+02	7.30E+00	7.30E+00	3.80E+01
7.22E+00	19	1.37E+02	7.22E+00	1.37E+02	1.37E+02	7.22E+00	7.22E+00	3.76E+01
7.19E+00	19	1.36E+02	7.19E+00	1.36E+02	1.36E+02	7.19E+00	7.19E+00	3.72E+01
7.18E+00	19	1.36E+02	7.18E+00	1.36E+02	1.36E+02	7.18E+00	7.18E+00	3.68E+01
7.18E+00	19	1.16E+02	7.18E+00	1.16E+02	1.16E+02	7.18E+00	7.18E+00	3.64E+01
7.09E+00	19	1.14E+02	7.09E+00	1.14E+02	1.14E+02	7.09E+00	7.09E+00	3.58E+01
7.08E+00	19	1.34E+02	7.08E+00	1.34E+02	1.34E+02	7.08E+00	7.08E+00	3.54E+01
7.07E+00	9	6.47E+01	7.07E+00	6.47E+01	6.47E+01	7.07E+00	7.07E+00	3.45E+01
7.04E+00	9	6.44E+01	7.04E+00	6.44E+01	6.44E+01	7.04E+00	7.04E+00	3.42E+01
7.00E+00	9	6.40E+01	7.00E+00	6.40E+01	6.40E+01	7.00E+00	7.00E+00	3.38E+01
6.99E+00	19	1.12E+02	6.99E+00	1.12E+02	1.12E+02	6.99E+00	6.99E+00	3.34E+01
6.98E+00	9	6.38E+01	6.98E+00	6.38E+01	6.38E+01	6.98E+00	6.98E+00	3.30E+01
6.98E+00	19	1.32E+02	6.98E+00	1.32E+02	1.32E+02	6.98E+00	6.98E+00	3.26E+01
6.95E+00	19	1.12E+02	6.95E+00	1.12E+02	1.12E+02	6.95E+00	6.95E+00	3.22E+01
6.95E+00	19	1.10E+02	6.95E+00	1.10E+02	1.10E+02	6.95E+00	6.95E+00	3.18E+01
6.86E+00	19	1.10E+02	6.86E+00	1.10E+02	1.10E+02	6.86E+00	6.86E+00	3.14E+01
6.84E+00	19	1.29E+02	6.84E+00	1.29E+02	1.29E+02	6.84E+00	6.84E+00	3.10E+01
6.82E+00	19	1.29E+02	6.82E+00	1.29E+02	1.29E+02	6.82E+00	6.82E+00	3.06E+01
6.79E+00	19	1.29E+02	6.79E+00	1.29E+02	1.29E+02	6.79E+00	6.79E+00	3.02E+01
6.79E+00	19	1.28E+02	6.79E+00	1.28E+02	1.28E+02	6.79E+00	6.79E+00	2.98E+01
6.75E+00	19	1.28E+02	6.75E+00	1.28E+02	1.28E+02	6.75E+00	6.75E+00	2.94E+01
6.73E+00	19	1.27E+02	6.73E+00	1.27E+02	1.27E+02	6.73E+00	6.73E+00	2.90E+01
6.70E+00	19	1.27E+02	6.70E+00	1.27E+02	1.27E+02	6.70E+00	6.70E+00	2.86E+01
6.68E+00	19	1.27E+02	6.68E+00	1.27E+02	1.27E+02	6.68E+00	6.68E+00	2.82E+01
6.57E+00	19	1.24E+02	6.57E+00	1.24E+02	1.24E+02	6.57E+00	6.57E+00	2.78E+01
6.56E+00	19	1.24E+02	6.56E+00	1.24E+02	1.24E+02	6.56E+00	6.56E+00	2.74E+01
6.53E+00	9	5.97E+01	5.97E+00	5.97E+01	5.97E+01	5.97E+00	5.97E+00	2.70E+01
6.46E+00	19	1.22E+02	6.46E+00	1.22E+02	1.22E+02	6.46E+00	6.46E+00	2.66E+01
6.33E+00	19	1.20E+02	6.33E+00	1.20E+02	1.20E+02	6.33E+00	6.33E+00	2.62E+01
6.33E+00	19	1.20E+02	6.33E+00	1.20E+02	1.20E+02	6.33E+00	6.33E+00	2.58E+01
6.31E+00	9	5.79E+01	5.79E+00	5.79E+01	5.79E+01	5.79E+00	5.79E+00	2.54E+01
6.31E+00	19	1.19E+02	6.31E+00	1.19E+02	1.19E+02	6.31E+00	6.31E+00	2.50E+01
6.31E+00	19	1.19E+02	6.31E+00	1.19E+02	1.19E+02	6.31E+00	6.31E+00	2.46E+01
6.30E+00	19	1.19E+02	6.30E+00	1.19E+02	1.19E+02	6.30E+00	6.30E+00	2.42E+01
6.27E+00	19	1.17E+02	6.27E+00	1.17E+02	1.17E+02	6.27E+00	6.27E+00	2.38E+01
6.27E+00	19	1.19E+02	6.27E+00	1.19E+02	1.19E+02	6.27E+00	6.27E+00	2.34E+01
6.26E+00	19	1.18E+02	6.26E+00	1.18E+02	1.18E+02	6.26E+00	6.26E+00	2.30E+01
6.26E+00	19	1.18E+02	6.26E+00	1.18E+02	1.18E+02	6.26E+00	6.26E+00	2.26E+01
6.24E+00	9	5.71E+01	5.71E+00	5.71E+01	5.71E+01	5.71E+00	5.71E+00	2.22E+01
6.19E+00	19	1.17E+02	6.19E+00	1.17E+02	1.17E+02	6.19E+00	6.19E+00	2.18E+01
6.19E+00	19	1.17E+02	6.19E+00	1.17E+02	1.17E+02	6.19E+00	6.19E+00	2.14E+01
6.17E+00	19	1.17E+02	6.17E+00	1.17E+02	1.17E+02	6.17E+00	6.17E+00	2.10E+01
6.16E+00	19	1.17E+02	6.16E+00	1.17E+02	1.17E+02	6.16E+00	6.16E+00	2.06E+01

80th  
Percentile

Summary for STAIR  
Maximum Radius = 50.0 Km

33h

Level	Concentration	Population	Exposure
1	1.56E+01	9	1.43E+02
2	1.00E+01	104	1.29E+03
3	5.00E+00	4,920	3.14E+04
4	2.50E+00	44,600	1.60E+05
5	1.00E+00	295,000	5.26E+05
6	5.00E-01	853,000	9.06E+05
7	2.50E-01	2,020,000	1.31E+06
8	1.00E-01	5,620,000	1.88E+06
9	4.00E-02	17,190,000	2.17E+06
10	2.00E-02	11,600,000	2.32E+06
11	1.00E-02	2,900,000	2.54E+06
12	5.00E-03	64,200,000	2.78E+06
13	2.50E-03	171,000,000	2.99E+06
14	1.00E-03	108,000,000	3.10E+06
15	5.00E-04	206,000,000	3.12E+06
16	2.50E-04	210,000,000	3.12E+06
17	1.00E-04	210,000,000	3.12E+06
18	5.00E-05	210,000,000	3.12E+06
19	4.40E-05	210,000,000	3.12E+06

Using a Risk Factor of 1.00E+00

Level	Risk Level	Population	Hazard
1	1.56E+01	9	1.43E+02
2	1.00E+01	104	1.29E+03
3	5.00E+00	4,920	3.14E+04
4	2.50E+00	44,600	1.60E+05
5	1.00E+00	295,000	5.26E+05
6	5.00E-01	853,000	9.06E+05
7	2.50E-01	2,020,000	1.31E+06
8	1.00E-01	5,620,000	1.88E+06
9	5.00E-02	17,190,000	2.17E+06
10	2.50E-02	11,600,000	2.32E+06
11	1.00E-02	2,900,000	2.54E+06
12	5.00E-03	64,200,000	2.78E+06
13	2.50E-03	171,000,000	2.99E+06
14	1.00E-03	108,000,000	3.10E+06
15	5.00E-04	206,000,000	3.12E+06
16	2.50E-04	210,000,000	3.12E+06
17	1.00E-04	210,000,000	3.12E+06
18	5.00E-05	210,000,000	3.12E+06
19	4.40E-05	210,000,000	3.12E+06

## **Appendix B.**

### **Data Concerning Hazard of Fine Mineral Fibers**

**Elements of Hazard Ranking****Chemical Name:** asbestos**CAS Number:** 1332-21-4**Weight-of-Evidence Classification:<sup>a</sup>** A**Estimate of Potency (1/ED<sub>10</sub>):** see comments

**Comments:** The data used to estimate an ED<sub>10</sub> are derived from numerous epidemiologic studies, but it is inappropriate to express the ED<sub>10</sub> in mg/kg/day equivalents because the carcinogenic potential is related to specific fiber shapes and sizes and atmospheric concentrations; there is no direct relationship between air concentrations (fibers/ml) and mass concentrations (mg/m<sup>3</sup> or mg/kg/day).

**Source:** U.S. Environmental Protection Agency, 1988. Evaluation of the potential carcinogenicity of asbestos. OHEA-C-073-23. Washington, DC: Office of Health and Environmental Assessment.

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<sup>a</sup>A-human carcinogen, B1-probably carcinogenic to humans (limited human evidence), B2-probably carcinogenic to humans (inadequate human evidence/no human data), C-possibly carcinogenic to humans, D-not classifiable as to human carcinogenicity, E-evidence of non-carcinogenicity for humans.

**Elements of Hazard Ranking****Chemical Name:** erionite**CAS Number:** not applicable**IARC Classification:<sup>\*</sup>** 1

**Comments:** Studies in humans exposed since birth in areas contaminated with erionite have observed high mortality from malignant mesothelioma. Additionally, lung tissue samples from inhabitants in these areas have shown higher proportions of erionite fibers and ferruginous bodies than those of controls taken from locations without erionite contamination. The epidemiologic evidence was considered by IARC as "sufficient evidence" for carcinogenicity to humans.

Erionite has produced increased incidences of mesotheliomas in mice by intraperitoneal injection and in rats by inhalation, intrapleural, and intraperitoneal administration.

Erionite has been tested in only a few short-term genetic tests. It induced transformation and unscheduled DNA synthesis in mouse C3H 10T1/2 cells and, *in vitro*, unscheduled DNA synthesis in human cells.

**Source:** International Agency for Research on Cancer, 1987. IARC Monographs on the evaluation of carcinogenic risks to humans. Supplement 7: 203-205.

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\*1-the agent is carcinogenic to humans, 2A-the agent is probably carcinogenic to humans (limited human evidence), 2B-the agent is possibly carcinogenic to humans (limited evidence in humans in the absence of sufficient evidence in animals, or inadequate human evidence/non-existent human data and sufficient evidence in animals), 3-the agent is not classifiable as to its carcinogenicity to humans, 4-the agent is probably not carcinogenic to humans.

### Elements of Hazard Ranking

Chemical Name: glasswool

CAS Number: not applicable

IARC Classification<sup>1</sup>: 2B

Comments: Two of three epidemiological studies show elevated mortality from respiratory cancer or lung cancer with occupational exposure to glass wool. Increases were not related to duration of exposure although one study showed the lung cancer increases were associated with time since first exposure. A large multinational European study did not observe excesses in lung cancer mortality when compared to local rates. IARC considered the epidemiologic data as "inadequate evidence" for carcinogenicity in humans.

Data in animals are considered "sufficient evidence" for the carcinogenicity of glasswool. Glasswool has produced increased incidences of lung tumors in rats and lung tumors and mesotheliomas in hamsters after intratracheal instillation, of pleural tumors in rats given intrapleural implantation or injection, and of mesotheliomas or sarcomas of the peritoneal cavity in rats with peritoneal injection.

Glasswool has induced chromosomal alterations but no sister chromatid exchanges in mammalian cell *in vitro* and morphological transformations in rodent cells *in vivo*.

Source: International Agency for Research on Cancer, 1988. IARC Monographs on the evaluation of carcinogenic risks to humans. Man-made mineral fibres and radon. Volume 43: 39-171.

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\*1-the agent is carcinogenic to humans, 2A-the agent is probably carcinogenic to humans (limited human evidence), 2B-the agent is possibly carcinogenic to humans (limited evidence in humans in the absence of sufficient evidence in animals, or inadequate human evidence/non-existent human data and sufficient evidence in animals), 3-the agent is not classifiable as to its carcinogenicity to humans, 4-the agent is probably not carcinogenic to humans.

**Elements of Hazard Ranking****Chemical Name:** rockwool**CAS Number:** not applicable**IARC Classification:<sup>\*</sup>** 2B

**Comments:** The overall classification of 2B is supported by "limited evidence" for carcinogenicity in humans and "limited evidence" for carcinogenicity in animals.

Among workers exposed to rock-/slagwool, increased mortality from lung cancer was observed when individual US and European cohorts were combined. Lung cancer risks appeared to increase (not statistically significant) in the European cohort with time since first exposure; highest risk was found after more than 20 years latency. No relationship was noted in either study with duration of exposure. IARC considered these data as "limited evidence" for carcinogenicity in humans.

Rockwool has produced in rats an increase in the incidence of pleural mesotheliomas (not statistically significant) and in abdominal cavity tumors after intraperitoneal injection. Two other studies in rats exposed via inhalation did not show any statistically significant increase in lung tumors. IARC considered these data as "limited evidence" for carcinogenicity in animals.

No adequate data on genetic and related effects of rockwool were available.

**Source:** International Agency for Research on Cancer, 1988. IARC Monographs on the evaluation of carcinogenic risks to humans. Man-made mineral fibres and radon. Volume 43: 39-171.

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<sup>\*</sup>1-the agent is carcinogenic to humans, 2A-the agent is probably carcinogenic to humans (limited human evidence), 2B-the agent is possibly carcinogenic to humans (limited evidence in humans in the absence of sufficient evidence in animals, or inadequate human evidence/non-existent human data and sufficient evidence in animals), 3-the agent is not classifiable as to its carcinogenicity to humans, 4-the agent is probably not carcinogenic to humans.

**Elements of Hazard Ranking**

Chemical Name: slagwool

CAS Number: not applicable

IARC Classification\*: 2B

Comments: The overall classification of 2B is supported by "limited evidence" for carcinogenicity in humans and "inadequate evidence" for carcinogenicity in animals.

Among workers exposed to rock-/slagwool, increased mortality from lung cancer was observed when individual US and European cohorts were combined. Lung cancer risks appeared to increase (not statistically significant) in the European cohort with time since first exposure; highest risk was found after more than 20 years latency. No relationship was noted in either study with duration of exposure. IARC considered these data as "limited evidence" for carcinogenicity in humans.

Slagwool has produced in rats an increase in the incidence of pleural mesotheliomas (not statistically significant) and in abdominal cavity tumors after intraperitoneal injection. Two other studies in rats exposed via inhalation did not show any statistically significant increase in lung tumors. IARC considered these data as "limited evidence" for carcinogenicity in animals.

No adequate data on genetic and related effects of slagwool were available.

Source: International Agency for Research on Cancer, 1988. IARC Monographs on the evaluation of carcinogenic risks to humans. Man-made mineral fibres and radon. Volume 43: 39-171.

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\*1-the agent is carcinogenic to humans, 2A-the agent is probably carcinogenic to humans (limited human evidence), 2B-the agent is possibly carcinogenic to humans (limited evidence in humans in the absence of sufficient evidence in animals, or inadequate human evidence/non-existent human data and sufficient evidence in animals), 3-the agent is not classifiable as to its carcinogenicity to humans, 4-the agent is probably not carcinogenic to humans.