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October 29,2002

TELECOPY AND REGULAR U.S. MAIL

Christopher Jones
Director, Ohio Environmental Protection Agency
122 South Front Street
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Columbus, OH 432 16-1049

Robert Hodanbosi
Director, Division of Air Pollution Control
Ohio Environmental Protection Agency
122 South Front Street
P.O. Box 1049
Columbus, OH 432 16-1049

Ohio EPA, Southeast District Office
Air Pollution Group
2195 Front Street
Logan, OH 43138

Re: Emissions Of Ammonium Perfluorooctanoate (C-8) Into Ohio Air From DuPont's Washington Works Facility In Wood County, West Virginia

Dear Gentlemen:

Our law firm currently represents the Plaintiffs in a class action lawsuit pending against E.I. duPont de Nemours and Company ("DuPont") and the Lubeck Public Service District ("LPSD") of Wood County, West Virginia styled *Jack W. Leach, et al. v. E.I. duPont de Nemours and Company and Lubeck Public Service District* (Circuit Court of Wood Cty, WV, Civil Action No. 01-C-608) involving claims that DuPont has improperly released ammonium perfluorooctanoate (CAS. No. 3825-26-1) (a/k/a "C-8") into the environment from its Washington Works plant in Wood County, West Virginia. Although C-8 is not specifically regulated in either West Virginia or Ohio in terms of air emissions, Year 2000 air emissions modeling data generated by DuPont and the State of West Virginia's Department of Environmental Protection indicate that the emissions of **C-8** from DuPont's Washington Works have resulted in concentrations of C-8 in the air over communities in Ohio at levels far exceeding all known regulatory standards for **C-8** air emissions. More specifically, our research to date indicates that those jurisdictions that actually have established regulatory standards for C-8 in air consistently have adopted standards of between 0.01 mg/u3 and 0.1 mg/u3 as the appropriate safety level for C-8 in air (typically "healthy" worker populations). *(See* Exhibit A (copies of air

emissions standards from California, Michigan, New Hampshire, Canada (Saskatchewan, Ontario, and British Columbia), Belgium, New Zealand, and Holland).) DuPont's own Year 2000 air modeling data confirms levels of C-8 in local community air in Ohio as high as 0.8 mg/u3 and over **2** mg/u3 at DuPont's fence line. ***(See*** Exhibit B.) Residents in some of these communities also are receiving additional doses of C-8 in their drinking water, which has been contaminated by C-8 releases from DuPont's Washington Works facility, and may be exposed to C-8 in soils. ***(See*** Exhibit C.)

Unfortunately, despite the State of West Virginia's possession of DuPont's air modeling data for many months, the State of West Virginia has, to date, done nothing to require DuPont to take action to remediate its C-8 air releases, despite having the authority to do so under a Consent Order entered between DuPont and the State of West Virginia in November of 2001. *(See* Exhibit D.) We understand that the State of West Virginia has delayed taking any such action while it works with DuPont to see if DuPont can generate current stack emissions data showing C-8 emissions lower than a new C-8 air "screening level" recently adopted by the State of West Virginia through a "C-8 Assessment of Toxicity Team" ("CAT Team") established under the November 2001 Consent Order with DuPont. The CAT Team, which included several representatives of DuPont and no members from Ohio EPA, selected a median "screening level" for C-8 in air of 1 mg/u3, which is several magnitudes higher than any regulatory limit for C-8 that we are aware of in any other jurisdiction. The CAT Team's median "screening level" is even higher than DuPont's own internal air standard for C-8 of 0.3 ug/m3 and higher than WVDEP's earlier preliminary screening level for C-8 of 0.02 ug/m3 (see Exhibit E). West Virginia also has said nothing about the cumulative dose that local residents are receiving through C-8 in air. water and possibly soils. WVDEP's lack of action contrasts dramatically with the new "high priority" level of concern being expressed by USEPA with respect to C-8 toxicity, particularly given its recently-confirmed reproductive and developmental effects. (See Exhibit F)

Because DuPont's own air emissions modeling data from its Washington Works plant confirms that DuPont's C-8 emissions are exceeding all known regulatory limits for C-8 in Ohio's air and the State of West Virginia has done nothing to require DuPont to stop or abate those

emissions, we hereby request on behalf of our clients that Ohio EPA take immediate action to require DuPont to stop and remediate its releases of **C-8** into the air in Ohio. We look forward to confirmation as to how Ohio EPA plans to proceed in this matter. Thank you.

Very truly yours,

Robert A. Bilott

RAB/mdm
Enclosures (by regular U.S. mail)
cc: R. Edison Hill, Esq. (w/ encls.)
Larry A. Winter, Esq. (w/ encls.)
Gerald J. Rapien, Esq. (w/ encls.)
Greg Smith, Esq. (Ohio EPA Legal) (w/ encls.)
Lillian Pinzon, Esq. (USEPA, Region 5) (w/ encls.)
Janet Sharke, Esq. (USEPA, Region 3) (w/ encls.)

A

Minnesota Rules, 5206.0400 HAZARDOUS SUBSTANCES

Subpart 1. In general. The commissioner has determined that the list of hazardous substances in subpart 5 shall be covered by the provisions of this chapter. The hazardous substance list includes the majority of hazardous substances that will be encountered in Minnesota; it does not include all hazardous substances and will not always be current. Employers shall exercise reasonable diligence in evaluating their workplace for the presence of other recognized hazardous substances and assure that employees are provided with the rights stated in this chapter.

Subp. 2. Exemptions. Substances or mixtures within the categories in items **A** to K are exempt from coverage under this standard.

A. Products intended for personal consumption by employees in the workplace.

B. Consumer products packaged for distribution to, and used by, the general public, including any product used by an employer or the employer's employees in the same form, concentration, and manner as it is sold to consumers, and to the employer's knowledge, employee exposure is not significantly greater than the consumer exposure occurring during principal consumer use of the product.

C. Any article, including but not limited to an item of equipment or hardware, which contains a hazardous substance, if the substance is present in a solid form which does not create a health hazard as a result of being handled by the employee.

D. Any hazardous substance that is bound and not released under normal conditions or work or in a reasonably foreseeable occurrence resulting from workplace operations.

E. Products sold or used in retail food sale establishments and all other retail trade establishments, exclusive of processing and repair work areas.

F. Any waste material regulated pursuant to the federal Resource Conservation and Recovery Act, Public Law Number 94-580, but only with respect to any employer in a business which provides a service of collection, processing, or disposal of such waste.

G. Waste products labeled pursuant to the Resource Conservation and Recovery Act. If hazardous substances make up the waste product, the employer must assure that mixing of incompatible substances does not occur.

H. Any substance received by an employer in **a** sealed package and subsequently sold or transferred in that package, if the seal remains intact while the substance is in the employer's workplace.

I. Any substance, mixture, or product if present in a physical state, volume, or mixture concentration for which there is no valid and substantial evidence that a significant risk to human health may occur from exposure.

J. "Fume" - Small solid particles formed by the condensation of vapors of solid materials.

K. "Gases" - Refers to displacement of air asphyxiation hazard.

L. "Skin" - If a potential for absorption from skin contact merits special consideration, the word, "skin" follows the substance name.

M. (number) - The number in parentheses following each substance is the American Chemical Society's Chemical Abstract Service (CAS) number for that substance. A particular substance may be known by more than one name. The CAS number eliminates the confusion caused by synonyms.

N. a = Alpha.

O. β = Beta.

Subp. 5. List of hazardous substances. List of hazardous substances:

A. Hazardous substances beginning with the letter A:
(1) Abate (see Temephos)
(2) *A-a-C (2-Amino-9H-pyrido[2,3-b]indole) R
(3) *Acetaldehyde (75-07-0) AO
(4) *Acetamide R
(5) Acetic acid (64-19-7) AO
(6) Acetic anhydride (108-24-7) AO
(7) Acetone (67-64-1) AON
(8) Acetone cyanohydrin (75-86-5) IN
(9) Acetonitrile-skin (75-05-8) ANO
(10) Acetophenone (98-86-2) AI
(11) *2-Acetylaminoflourene (53-96-3) ONT
(12) Acetylene (74-86-2) AN
(13) Acetylene dichloride (see 1,2-Dichloroethylene)
(14) Acetylene tetrabromide (79-27-6) AO
(15) Acetylsalicylic acid (Aspirin) (50-78-2) A
(16) Acrolein (107-02-8) AO
(17) *Acrylamide-skin (79-06-1) ANOR
(18) Acrylic acid (79-10-7) A
(19) *Acrylonitrile-skin (107-13-1) ANORT
(20) *Actinomycin D (50-76-0) R
(21) Adipic acid (124-04-9) A
(22) Adiponitrile (111-69-3)-skin A
(23) *Adriamycin (23214-92-8) RT
(24) *AF-2 [2-(2-furyl)-3-(5-nitro-2-furyl) acrylamide] (3688-53-7) R
(25) *Aflatoxins (1402-68-2) RT
(26) Alkanes N
(27) *Aldrin-skin (309-00-2) AN
(28) Allyl alcohol-skin (107-18-6) AO
(29) *Allyl chloride (107-05-1) ANO
(30) Allyl glycidyl ether (AGE)-skin (106-92-3) ANO
(31) Allyl isothiocyanate-skin (57-06-7) I
(32) Allyl propyl disulfide (2179-59-1) AO

(33) a-Alumina (1344-28-1) A
(34) Aluminum pyro powders (7429-90-5) **A**
(35) Aluminum welding fumes (7429-90-5) **A**
(36) Aluminum, soluble salts (7429-90-5) **A**
(37) Aluminum, metal dust (7429-90-5) **A**
(38) Aluminum oxide (I 344-28-1) **A**
(39) Aluminum, alkyls (7429-90-5) **A**
(40) *2-Aminoanthraquinone (117-79-3) T
(41) *para-Aminoazobenzene R
(42) *ortho-Aminoazotoluene R
(43) p-Aminobenzoic acid (150-13-0) I
(44) Aminobiphenyl (see 4-Aminodiphenyl)
(45) *4-Aminodiphenyl-skin (92-67-1) ANOT
(46) 2-Aminoethanol (see Ethanolamine)
(47) *1-Amino-2-methylanthraquinone (82-28-0) T
(48) *2-Amino-5-(5-nitro-2-furyl)-1,3,4-thiadiazole R
(49) 2-Aminopyridine (504-29-0) AO
(50) 3-Amino 1,2,4-triazole (see Amitrole)
(51) *Amitrole (61-82-5) ART
(52) Ammonia (7664-41-7) ***ANOS***
(53) Ammonium chloride, fume (12125-02-9) **A**
(54) Ammonium perfluorooctanoate-skin (3825-26-1) **A**
(55) Ammonium sulfamate (7773-06-0) AO
(56) n-Amyl acetate (628-63-7) AO
(57) sec-Amyl acetate (626-38-0) AO
(58) *Analgesic mixture containing phenacetin R
(59) *Aniline and homologues-skin (62-53-3) AO
(60) *Anisidine (o-p isomers)-skin (29191-52-4) AOT
(61) *o-Anisidine hydrochloride (I 34-29-2) T
(62) *Anthracene oils R
(63) Antimony and compounds, **as** Sb (7440-36-0) ANO
(64) *Antimony trioxide, handling and use, **as** Sb production (1309-64-4) **A**
(65) ANTU (a-Naphthyl thiourea) (86-88-4) AO
(66) *Aramite" (140-57-8) R
(67) Argon (7440-37-1) **A**
(68) *Arsenic, elemental inorganic, and organic compounds, as **As** (7440-38-2) ANORT
(69) Arsine (7784-42-1) ANO
(70) *Asbestos (all forms) (1332-21-4) **ANORT**
(71) Asphalt (petroleum) fumes (8052-42-4) AN
(72) Atrazine (1912-24-9) **A**
(73) *Auramine (technical grade) (492-80-8) R
(74) *Azaserine R
(75) *Azathioprine (446-86-6) RT
(76) Azinphos-methyl-skin (86-50-0) AO

B. Hazardous substances beginning with the letter B:
(1) Barium, soluble compounds, **as Ba** (7440-39-3) AO
(2) Barium, sulfate (7727-43-7) **A**
(3) Baygon (Propoxur) (1 14-26-1) **A**
(4) Baytex (see Fenthion)
(5) Benomyl (17804-35-2) **A**

Section 7

OSHA Designated Hazardous Chemicals

According to the OSHA Hazard Communication Standard (1910.1200), a hazard determination must consider the chemicals listed in the following sources to be hazardous:

1. Chemicals regulated by OSHA in 29 CFR Part 1910, Subpart Z.
2. Threshold Limit Values for Chemical Substances and Physical Agents in the Work Environment, American Conference of Governmental Industrial Hygienists (latest edition).
3. National Toxicology Program, Annual Report on Carcinogens (latest edition).
4. International Agency for Research on Cancer Monographs (latest edition).

The substances found in the above sources (December 1990) have been compiled in Appendix L.

The fact that a chemical is not listed does not mean it is not hazardous. Any chemical that presents a potential health or physical hazard to which employees may be exposed must be included in the hazard communication program.

Chemical Safety Manual Contents

Health and Safety Manual Contents

Office of Health and Safety, Centers for Disease Control and Prevention,
1600 Clifton Road N.E., Mail Stop F05 Atlanta, Georgia 30333, USA
Last Modified: 1/2/97

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APPENDIX K

PELs AND TLV's FOR CHEMICAL SUBSTANCES

Acetaldehyde	200	360			25(C)	45(C)
Acetic acid	10	25	10	25	15	37
Acetic anhydride	5	20	5	21		
Acetone	1000	2400	500	1188	750	1782
Acetone cyanohydrin as CN-Skin					4.7(C)	5(C)
Acetonitrile			40	67	60	101
Acetophenone			10	49		
Acetylene-simple asphyxiant						
2-Acetylaminofluorene-No occupational exposure limits established						
Acetylene tetrabromide	1	14	1	14		
Acetylsalicylic acid (Aspirin)				5		
Acrolein	0.1	0.25	0.1	0.23	0.3	0.69
Acrylamide-Skin		0.3		0.03		
Acrylic acid-Skin			2	5.9		
Acrylonitrile-Skin	2		2	4.3		
Adipic acid				5		
Adiponitrile-Skin			2	8.8		
Aldrin-Skin		0.25		0.25		
Allyl alcohol-Skin	2	5	2	4.8	4	9.5
Allyl chloride	1	3	1	3	2	6
Allyl glycidyl ether **(AGE)**	10(C)	45(C)	5	23	10	47
Allyl propyl disulfide	2	12	2	12	3	18
Aluminum metal		5				
Metal Dust				10		

Pyro powders, as Al				5		
Welding fumes, as Al				5		
Soluble salts, as Al				2		
Alkyls, as Al				2		
Aluminum oxide	10	5		10		
4-Amino diphenyl-Skin-No exposure by any route shall be permitted (respiratory, skin or oral)						
2-Aminopyridine	0.5	2	0.5	1.9		
Amitrole				0.2		
Ammonia	50	35	25	17	35	24
Ammonium chloride fume				10		20
Ammonium perfluorooctanoate-Skin				0.01		
Ammonium sulfamate				10		
n-Amyl acetate	100	525	100	532		
sec-Amyl acetate	125	650	125	665		
Aniline & homologues-Skin	5	19	2	7.6		
o and p-Anisidine-Skin		0.5	0.1	0.5		
Antimony & compounds, as Sb		0.5		0.5		
Antimony trioxide production-exposure by all routes should be carefully controlled to levels as low as possible						
ANTU				0.3		
Argon-simple asphyxiant						
Arsenic, elemental & inorganic compounds except arsine, as As		0.5		0.01		
Arsine	0.05	0.2	0.05	0.16		
Asbestos						
Amosite				0.5 f/cc		
Chrysotile				2 f/cc		
Crocidolite				0.2 f/cc		
Other forms				2 f/cc		
Asphalt (petroleum) fumes				5		
Atrazine				5		
Azinphos-methyl-Skin		0.2		0.2		
Barium		0.5		0.5		
Barium sulfate		5		10		
Benomyl		5	0.84	10		
Benz[a]anthracene		0.2				
Benzene-Skin	1		0.5	1.6	2.5	8

8 CCR Appendix t

Cal. Admin. Code tit. 8, Appendix t

BARCLAYS OFFICIAL CALIFORNIA CODE OF REGULATIONS
TITLE 8. INDUSTRIAL RELATIONS
DIVISION 1. DEPARTMENT OF INDUSTRIAL RELATIONS
CHAPTER 4. DIVISION OF INDUSTRIAL SAFETY
SUBCHAPTER 7. GENERAL INDUSTRY SAFETY ORDERS
GROUP 16. CONTROL OF HAZARDOUS SUBSTANCES
ARTICLE 107. DUSTS, FUMES, MISTS, VAPORS AND GASES
This database is current through 11/02/2001 Register 2001, No. 44.

Appendix to section 5155

(A) Computation for Exposures to Contaminants with Independent Health Effects.

The 8-hour time-weighted average concentration **(TWA)** of a single substance to which an individual is exposed during a workday shall be calculated using the following formula to determine compliance with the PEL specified in Table AC-1.

$$TWA = \frac{C_1T_1 + C_2T_2 + \ldots C_nT_n}{8\ [FN_a1]}$$

where T is the duration in hours of the exposure to a substance at the concentration C. For multiple substances with independent health effects, an independent comparison of each TWA with the corresponding PEL shall be made to determine compliance.

@a1 Note: Eight (8) is used as denominator regardless of total hours of workday.

EXAMPLE: To illustrate the use of this formula, assume an employee is exposed to airborne toluene at a concentration of 150 ppm for 2 hours, 75 ppm for 3 hours and 50 ppm for 4 hours during a 9-hour workday:

TWA = [(150 x 2) + (75 x 3) + (50 x 4)]/8 [FNa1] = 91 ppm.

The series of exposures in this example are equivalent to an 8-hour exposure at a concentration of 91 ppm which is below the PEL value of 100 pprn specified for toluene by Table AC-1.

(B) Computation for Exposures to Contaminants with Additive Health Effects.

In the absence of information to the contrary, the adverse health effects of exposure to two or more toxic materials during the workday shall be considered additive and the following formula shall be used for calculating D, the fraction of the allowable daily exposure.

$$D = \frac{TWA_1}{PEL_1} + \frac{TWA_2}{PEL_2} + \ldots \frac{TWA_n}{PEL_n}$$

where TWA is the time-weighted average concentration of a particular substances

involved in the exposure (as calculated by the formula in section (A) of this Appendix), and PEL is the corresponding permissible exposure limit for that substance as specified by Table AC-1. The value of D shall not exceed unity.

Health effects for multiple contaminants are not considered additive when different organs of the body are affected by individual substances, or where the same effect (such as narcosis) is produced by two substances but the PEL for one substance is bared on another effect. For example, an exposure to 1 ppm vinyl chloride would not add significantly to the narcotic effect of 100 ppm toluene, nor would 100 ppm toluene add to the carcinogenic effect of vinyl chloride.

TABLE AC-1

PERMISSIBLE EXPOSURE LIMITS FOR CHEMICAL CONTAMINANTS

[Note: The following TABLE/FORM is too wide to be displayed on one screen. You must print it for a meaningful review of its contents. The table has been divided into multiple pieces with each piece containing information to help you assemble a printout of the table. The information for each piece includes: (1) a three line message preceding the tabular data showing by line # and character # the position of the upper left-hand corner of the piece and the position of the piece within the entire table; and (2) a numeric scale following the tabular data displaying the character positions.]

****
******** This is piece 1. -- It begins at character 1 of table line 1. ********
****

Chemical Abstracts Registry Number [FN(a)]	Skin [FN(b)]	Name [FN(c)]	PEL [FN(d)] ppm [FN(e)]	PEL [FN(d)] mg/M<<super>>3 [FN(f)]
75070		Acetaldehyde	25	45
64197		Acetic acid	10	25
108247		Acetic Anhydride	5	20
67641		Acetone	750	1780
75865		Acetone cyanohydrin as CN	v.7	5
75058	S	Acetonitrile	40	
98862		Acetophenone	10	49
53963	S	2-Acetylaminofluorene; N-fluoren-2-yl acetamide; see Section 5209		
74862		Acetylene	[FN(h)]	
540590		Acetylene dichloride; see 1,2-Dichloroethylene		
79276		Acetylene tetrabromide: 1,1,2,2-tetrabromoethane	1	14
793115		Acetylene tetrachloride; see 1,1,2,2-Tetrachloroethane		
50782		Acetylsalicylic acid (Aspirin)	-	5
107028		Acrolein	0.2	0.25
79061	S	Acrylamide	-	0.03
79107	S	Acrylic acid	2	5.9
107131	S	Acrylonitrile; see Section	2	4.5

000204

		5213		
I424049		Adiptic acid	-	5
111693	S	Adiponitrile	2	8.8
309002	S	Aldrin; 1,2,3,4,10,10-hexachloro-1,4,4a,5,8,8a-hexahydro-endo-1,2-exo-5,8-dimethanonaphthalene	-	0.25
107186	S	Allyl alcohol	2	5
107051		Allyl chloride	1	3
106923	S	Allyl glycidyl ether; AGE	5	22
2179591		Allyl Propyl disulfide	2	12
1344281		Alumina; see Particulates not otherwise regulated		
		Aluminum- alkyis (not otherwise classified)	-	2
		Aluminum soluble salts	-	2
		Aluminum metal and oxide	-	
		Total dust	-	10
		Respirable fraction [FN(n)]	-	5 [FN(n)]
		Aluminum pyro powders	-	5
		Aluminum welding fumes	-	5
300925		Aluminum distearate	-	10
7047849		Aluminum stearate	-	10
637127		Aluminum tristearate	-	10
1300738		Aminodimethylbenzenei see Xylidene		
92671	S	4-Aminodiphenyli see Section 5209		
141435		2-Aminoethanoli see Ethanolamine		
91598		2-Aminonapthalene; see beta-Naphthylamine, Section *5209*		
504290		2-Aminopyridine	0.5	2
61825		Amitrole	-	*0.2*
7bb4417		Ammonia	25	18
3825261	S	Ammonium perfluorooctanoate	-	0.01
12125029		Ammonium chloride fume	-	10
1002897		Ammonium stearate	-	10
7773060		Ammonium sulfamate	-	
		Total dust	-	10
		Respirable fraction [FN(n)]	-	5
628637		n-Amyl acetate	100	532
626380		sec-Amyl acetate (all isomers and mixtures)	125	665
62533	S	Aniline	2	7.6
29191524	S	Anisidine (ortho and para isomers)	0.1	0.5
		Antimony and compounds, as Sb	-	0.5
86884		ANTU; 1-(1-naphthyl)-2-thiourea; Bantu; Rattrack	-	0.3
7440371		Argon	(h)	
7440382		Arsenic and inorganic arsenic compounds; see also		
		Section 5214	0.01	
		Arsenic, organic compounds, as At	-	*0.2*
7784421		Arsine; AsH<<sub>>3	0.05	0.2
1332-21-4		Asbestos (including actinolite, amosite anthophyllite, chrysotile-crocidolite, and		

WSR 99-20-005

PERMANENT RULES

PUGET SOUND

CLEAN AIR AGENCY

[Filed September 24, 1999, 8:53 a.m. , effective November 1, 1999]

Date of Adoption: September 9, 1999.

purpose: To identify specific chemicals that are part of a hazardous air pollutant compound listed in Section 112(b) of the federal Clean Air Act.

Citation of Existing Rules Affected by this Order: Amended Regulation III - A.

Statutory Authority for Adoption: Chapter 70.94 RCW.

Adopted under notice filed as WSR 99-16-090 on August 4, 1999

Number of Sections Adopted in Order to Comply with Federal Statute: New 0, Amended 0, Repealed 0; Federal Rules or Standards: New 0, Amended 0, Repealed 0; or Enacted State Statutes: New 0, Amended 0, Repealed 0.

Number of Sections Adopted at Request of a Nongovernmental Entity: New 0, Amended Repealed 0.

Number of Sections Adopted on the Agency's Cwn Initiative: New 0, Amended 0, Repealed 0.

Number of Sections Adopted in Order to Clarify, Streamline, or Reform Agency Procedures: New 0, Amended 0, Repealed 0.

Number of Sections Adopted Using Negotiated Rule Making: New 0, Amended 0, Repealed 0; Pilot Rule Making: New 0, Amended 0, Repealed 0; or Other Alternative Rule Making: New 0, Amended 0, Repealed 0. Effective Date of Rule: November 1, 1999.

September 21, 1999

John K. Anderson

Senior Engineer

AMENDATORY SECTION

REGULATION III APPENDIX A: ACCEPTABLE SOURCE IMPACT LEVELS

COMPOUND NAME	CAS CODE	ASIL µg/m³	N P E
ANTU	86-88-4	I.0	B
√Acetaldehyde	75-07-0	0.45	A
	60-35-5	TBD	B

√Acetamide			
Acetic acid	64-19-7	83	B
Acetic anhydride	108-24-7	67	B
Acetone	67-64-1	5900	B
√Acetonitrile	75-05-8	220	B
√Acetophenone	98-86-2	TBD	B
√2-Acetylaminofluorene	53-96-3	TBD	A
Acetylene tetrabromide	79-27-6	47	B
√Acrolein	107-02-8	0.02	B
√Acrylamide	79-06-1	0.00077	A
√Acrylic acid	79-10-7	0.30	B
√Acrylonitrile	107-13-1	0.015	A
Aldrin	309-00-2	0.0002	A
Allyl alcohol	107-18-6	17	B
√Allyl chloride	107-05-1	1.0	B
Allyl glycidyl ether (AGE)	106-92-3	77	B
Allyl propyl disulfide	2179-59-1	40.0	B
Aluminum, AI alkyls	7429-90-5	6.7	B
Aluminum, as Al metal dusts	7429-90-5	33	B
Aluminum, as AI pyro powders	7429-90-5	17	B
Aluminum, as Al soluble salts	7429-90-5	6.7	B
Aluminum, as Al welding fumes	7429-90-5	17	B
2-Aminoanthraquinone	117-79-3	TBD	A
o-Aminoazotoluene	97-56-3	TBD	A
44-Aminobiphenyl	92-67-1	TBD	A
2-Aminopyridine	504-29-0	6.3	B
Amitrole	61-82-5	0.06	C
Ammonia	7664-41-7	100	B
Ammonium chloride fumes	12125-02-9	33	B
Ammonium perfluorooctanoate	3825-26-1	0.33	B
Ammonium sulfamate	7773-06-0	33	B
n-Amyl acetate	628-63-7	1800	B
sec-Amyl acetate	626-38-0	2200	B
√Aniline	62-53-3	6.3	A
√ Aniline and homologues	62-53-3	1.0	B
Anisidine (o-,p- isomers)	29191-52-4	1.7	B
√ o-Anisidine	90-04-0	1.7	C
√ Antimony & compounds, as Sb	7440-36-0	1.7	B
√ Antimony trioxide, as Sb (antimony compound)	1309-64-4	1.7	B
√Arsenic and inorganic arsenic compounds	7440-38-2	0.00023	A
√ Arsine	7784-42-1	0.53	B
J Asbestos (Note: fibers/ml)	1332-21-4	0.0000044	A
Asphalt (petroleum) fumes	8052-42-4	17	B

Home

Exposure limits:

Country / Effects	M	Time	TWAppm	TWAmg	STELppm	STELmg
*** ABATE						
CAS: 3383-96-8		RTECS: TF 6890000				
NZTHERLANDS			-	10	-	-
*++ ACETALDEHYDE						
			100	180	-	-
*** ACETIC ACID						
CAS: 64-19-7		RTECS: AF 1225000	10	25	-	-
*** ACETIC ANHYDRIDE						
CAS: 108-24-7		RTECS: AK 1325000	5	20	-	-
	C					
*** ACETONE						
CAS: 67-64-1		RTECS: AL 3150000	750	1780	-	-
*** ACETONITRILE						
CAS: 75-05-8		RTECS: AL 7700000	40	70	-	
*** ACETYLENE						
CAS: 74-86-2		RTECS: AO 9600000				
	ASP					
*** o-ACETYLSALICYLIC ACID						
CAS: 50-78-2		RTECS: VO 0700000		5	-	
*** ACROLEIN						
cas: 107-02-8		RTECS: AS 1050000	0.1	0.25	-	-
*** ACRYLAMIDE						
CAS: 73-06-1		RTECS: AS 3325000	-	0.3	-	-
	H					
*** ACRYLIC ACID						
CAS: 79-10-7		RTECS: AS 4375000	10	30	-	-
*** ACRYLONITRILE						
CAS: 107-13-1		RTECS: AT 5250000	4	9	10	22

H

*** ALDRIN
CAS: 309-00-2 RTECS: IO 2100000 0.25 - -
H

*** ALLYL ALCOHOL
CAS: 107-18-6 RTECS: BA 5075000 2 5 - -
H

*** ALLYL PROPYL DISULFIDE
CAS: 2179-59-1 RTECS: JO 0350000 2 12 - -

*** 1-ALLYL-2,3-EPOXYPROPYL ETHER
CAS: 106-92-3 RTECS: RR 0875000 5 22 - -
H

*** ALUMINUM ALKYL COMPOUNDS (as Al)
CAS: 7429-90-5 RTECS: BD 0330000 2 - -

*** ALUMINUM OXIDE
CAS: 299-86-5 RTECS: TB 3850000 10 - -

*** 2-AMINOPYRIDINE
CAS: 504-29-0 RTECS: US 1575000 0.5 2 - -

*** AMITROLE
CAS: 61-92-5 RTECS: XZ 3850000 0.2 - -

*** AMMONIA
CAS: 7664-41-7 RTECS: BO 0875000 25 18 - -

*** AMMONIUM CHLORIDE (fumes)
CAS: 12125-02-9 RTECS: BP 4550000 10 - -

*** AMMONIUM PERFLUOROOCTANOATE
CAS: 3825-26-1 RTECS: RH 0782000 0.1 - -

*** AMMONIUM SULFAMATE
CAS: 7773-06-0 RTECS: WO 6125000 10 - -

*** n-AMYL ACETATE
- - *100 *530

*** AMYL ACETATE (all isomers)
CAS: NOT AVAILABLE RTECS: AJ 2010000 - - *100 *530

*** ANTU

CAS Number	Description	OEL (mg/m3)	24-hr AAL (ug/m3)	Annual AAL (ug/m3)	24-hr Demin (lb/hr)	Annual Demin (lb/yr)
75 - 7 - 0	Acetaldehyde (Ethanal)	45	161	9	1.50E-02	29.500
[illegible]	[illegible]					**
64 - 19 - 7	Acetic Acid	25	126	84	1.18E-02	275.00
108 - 24 - 7	Aceticanhydride	21	148	70	1.38E-02	231.00
67 - 64 - 1	Acetone(2-Propanone)	1188	4243	2829	3.97E-01	9280.0
75 - 86 - 5	Acetonecyanohydrin	5	18	12	1.67E-03	39.100
75 - 5 - 8	Acetonitrile (Methyl cyanide)	67	239	160	2.24E-02	523.00
98 - 86 - 2	Acetophenone(incl:benzene from gasoline)	49	246	164	2.31E-02	539.00
53 - 96 - 3	2- Acetylaminoflourene					**
79 - 27 - 6	Acetylene tetrabromide	14	70	47	6.59E-03	154.00
50 - 78 - 2	Acetylsalicylic acid	5	25	12	2.34E-03	39.100
107 - 2 - 8	Acrolein (2-Propenal)	0.23	0.821	0.02	7.69E-05	6.56E-02
79 - 6 - 1	Acrylamide	0.03	0.107	0 071	1.00E-05	2.34E-01
79 - 10 - 7	Acrylic acid (2-Propeonic acid)	5.9	21	1	1.97E-03	3.280
107 - 13 - 1	Acrylonitrile	4.3	15	2	1.44E-03	6.560
124 - 4 - 9	Adipic acid	5	104	50	9.75E-03	163.00
111 - 69 - 3	Adiponitrile	8.8	44	21	4.12E-03	68.700
309 - 0 - 2	Aldrin	0.25	0.893	0.595	8.36E-05	1.950
7429 - 90 - 5	Alkyls, as Al	2	10	6.707	9.42E-04	22.000
107 - 18 - 6	Allyl alcohol	4.8	17	11	1.61E-03	37.500
107 - 5 - 1	Allyl chloride	3	11	1	1.00E-03	3.280
106 - 92 - 3	Allyl glycidyl ether	4.67	23	16	2.20E-03	51.400
2179 - 59 - 1	Allyl propyl disulfide	12	500	119	4.68E-02	391.00
7429 - 90 - 5	Aluminum (dust)	10	50	34	4.71E-03	110.00
1344 - 28 - 1	Aluminum oxide	10	149	99	1.39E-02	325.00
62 - 53 - 3	Aminobenzene; (Aniline; Phenyl Amine).	7.6	27	1	2.54 E-03	3.280
92 - 67 - 1	4- Arninodiphenyl	0 0069	0 025	0 016	2.31E-06	5.39E-02
141 - 43 - 5	2- Aminoethanol; (Ethanolamine)	7.5	27	18	2.51E-03	58.600
134 - 32 - 7	1- Aminonaphthalene; (1-Naphthylamine)					**
91 - 59 - 8	2- Aminonaphlhalene; (2-Naphthlarninine)	0.005	0 018	0 012	1.67E-06	3.91E-02
91 - 59 - 8	2- Aminonaphthalene; (a-Naphthlaminine; 2-Na	0.005	0 018	0.012	1.67E-06	3.91E-02
504 - 29 - 0	2- Arninopyridine	1.9	6 786	4.524	6.35E-04	14.800
61 - 82 - 5	Amitrole	0.2	0.714	0 476	6.69E-05	1.560
7664 - 41 - 7	Ammonia	17	100	100	9.36E-03	328.00

CAS Number	Description	OEL (mg/m3)	24-hr AAL (ug/m3)	Annual AAL (ug/m3)	24-hr Demin. (lb/hr)	Annual Demin (lb/yr)
12125 - 2 - 9	Ammonium chloride fume	10	417	99	3.90E-02	325.00
3825 - 26 - 1	Ammonium perfluorooctanoate	0.01	0.05	0.024	4.68E-06	7.81E-02
7773 - 6 - 0	Ammonium sulfamate	10	149	99	1.39E-02	325.00
626 - 38 - 0	c- Amyl acetate	665	9896	6597	9.27E-01	21600
628 - 63 - 7	n- Amyl acetate; (Pentyl acetate)	532	2676	1784	2.51E-01	'5850.0
62 - 53 - 3	Aniline (Phenyl amine; Aminobenzene)	7.6	27	1	2.54E-03	3.280
90 - 4 - 0	o- Anisidine	0.5	2.515	1.677	2.35E-04	5.500
104 - 94 - 9	p- Anisidine	0.5	2 515	1.677	2.35E-04	5.500
7440 - 36 - 0	Antimony	0.5	1.786	1.19	1.67E-04	3.910
1309 - 64 - 4	Antimony trioxide	0.5	1.786	0.2	1.67E-04	6.56E-01
86 - 88 - 4	ANTU (1-Naphthalenylthiourea)	0.3	1.071	0.714	1.00E-04	2.340
7440 - 38 - 2	Arsenic	0.01	0.036	0.024	3.34E-06	7.81E-02
7784 - 42 - 1	Arsine	0.16	0.571	0.05	5.35E-05	1.64E-01
8052 - 42 - 4	Asphalt (petroleum) fumes	5	25	17	2.35E-03	55.000
1912 - 24 - 9	Atrazine	5	18	12	1.67E-03	39.100
86 - 50 - 0	Azinphos-methyl	0.2	0.714	0.476	6.69E-05	1.560
7440 - 39 - 3	Barium	0.5	2.515	1.677	2.35E-04	5.500
1304 - 28 - 5	Barium Oxide (as barium)	0.5	2.515	1.677	2.35E-04	5.500
7727 - 43 - 7	Barium sulfate	10	417	99	3.90E-02	325.00
17804 - 35 - 2	Benomyl	10	36	24	3.34E-03	78.100
56 - 55 - 3	Benz[a]anthracene	0.1	0.357	0.238	3.34E-05	7.81E-01
71 - 43 - 2	Benzene	1.6	5.714	3.81	5.35E-04	12.500
108 - 98 - 5	Benzenethiol; (Phenyl mercaptan; Thiophenol	2.3	8.214	5.476	7.69E-04	18.000
92 - 87 - 5	Benzidine	0.008	0.001	0.001	1.87E-08	6.56E-04
50 - 32 - 8	Benzo[a]pyrene	0.1	0.005	0 005	4.48E-07	1.57E-02
205 - 99 - 2	Benzo[b]fluoranthene	0.1	0.357	0 238	3.34E-05	7.81E-01
98 - 7 - 7	Benzotrichloride	0.2	0.003	0.003	2.52E-07	8.83E-03
98 - 88 - 4	Benzoyl chloride	2.8	14	9.39	1.32E-03	30.800
94 - 36 - 0	Benzoylperoxide	5	25	17	2.35E-03	55.000
140 - 11 - 4	Benzyl acetate	61	307	205	2.87E-02	671.00
100 - 44 - 7	Benzyl chloride (a-chlorotoluene)	5.2	19	12	1.74E-03	40 600
7440 - 41 - 7	Beryllium and compounds (as Be)	0.002	0 02	0 02	1.87E-06	6.56E-02
1304 - 56 - 9	Beryllium Oxide (as beryllium)	0 002	0 02	0.02	1.87E-06	6.56E-02

ollutant Name	CAS #	1	2	3 A	3 B	5	W	1 Hr <25ft (lb/hr)	1 Hr 25 - < 40ft (lb/hr)	1 Hr 40 - <75ft (lb/hr)	1 Hr >=75ft (lb/hr)	24 Hr <25ft (lb/hr)	25 - <40ft (lb/hr)
etaldehyde	75-07-0	1			3B		W	3.36	10.7	20.6	55.3		
etic acid	64-19-7	1										1.32	5.12
etic anhydride	108-24-7	1										1.12	4.36
etone Cyanohydrin, as CN	75-86-5	1						1.22	3.89	7.48	20.1		
etonitrile	75-05-8	1					W					3.61	14.0
etophenone	98-86-2	1										2.64	10.3
rolein	107-02-8	1					W	0.0171	0.0545	0.105	0.281		
rylamide	79-06-1	1			3B							0.00161	0.00626
rylic acid	79-10-7	1				5						0.317	1.23
rylonitrile	107-13-1				3B		W						
dipic Acid	124-04-9	1										0.269	1.04
diponitrile	111-69-3	1										0.475	1.85
ramycin	23214-92-8				3B								
flatoxins	1402-68-2			3A									
ldrin	309-00-2		2									0.0134	0.0522
llyl alcohol	107-18-6	1										0.0638	0.248
llyl chloride	107-05-1	1					W					0.168	0.653
llyl glycidyl ether	106-92-3	1										0.251	0.974
luminum alkyls and soluble salts, as Al	7429-90-5	1										0.107	0.417
luminum pyro powders, as Al	7429-90-5	1										0.269	1.04
Aminoazotoluene (o-Aminoazotoluene)	97-56-3				3B								
Aminoazotoluene (2-Aminoazotoluene)	97-56-3				3B								
-Aminobiphenyl	92-67-1			3A									
mitrole	61-82-5		2		3B							0.0107	0.0417
mmonia	7664-41-7	1				5						0.935	3.63
mmonium perfluorooctanoate	3825-26-1	1										0.00054	0.00209
niline	62-53-3	1					W					0.409	1.59
- Anisidine and o-anisidine hydrochloride (mixtures and omers)	29191-52-4	1			3B							0.0271	0.105
ntimony and compounds, as Sb	7440-36-0	1										0.0269	0.104
ntimony hydride (Stibine)	7803-52-3		2									0.0274	0.107
ntimony trioxide	1309-64-4					5							
NTU	86-88-4		2									0.0161	0.0626
rsenic and inorganic compounds, as As	7440-38-2			3A									
rsine	7784-42-1	1				5						0.00856	0.0333
sbestos	1332-21-4			3A									
trazine	1912-24-9		2									0.269	1.04
zacitidine, 5-	320-67-2				3B								
zathioprine	446-86-6			3A									
zinphos-methyl	86-50-0		2									0.0107	0.0417
ziridine (Ethylenimine)	151-56-4	1										0.0473	0.184
arium soluble compounds, as Ba	7440-39-3	1										0.0269	0.104
aygon (Propoxur)	114-26-1		2									0.0269	0.104
enomyl	17804-35-2		2									0.537	2.09
enz(a)anthracene	56-55-3				3B								
ntene	71-43-2			3A									
enzidine	92-87-5			3A									
enzo(b)fluoranthene	205-99-2				3B								
enzo(j)fluoranthene	205-82-3				3B								
enzo(k)fluoranthene	207-08-9				3B								
enzo(a)pyrene	50-32-8				3B								
enzotrichloride	98-07-7				3B								
enzoyl chloride	98-88-4	1						0.215	0.684	1.31	3.53		

BRITISH COLUMBIA

Part 5 Chemical and Biological Substances

PREAMBLE

An exposure limit in this table is a maximum allowed airborne concentration and is not intended to represent a fine line between safe and harmful conditions. In determining an exposure limit, it is not possible to take into account all factors which could influence the effect that exposure to the substance may have on an individual worker. Therefore, for all hazardous substances, reaardless *of* any assianed exposure limit, the guiding principle is elimination of exposure or reduction to the lowest level that is reasonably achievable below the exposure limit.

Because of wide variation in individual susceptibility, some workers may experience discomfort from some substances at concentrations at or below the exposure limit, Others may be affected more seriously bv aaaravation of a pre-existing condition, or by development *of* an occupational illness. Furthermore, other workplace contaminants may affect an individual's response. The effects *of* combined chemical exposures are often unknown or poorly defined.

Simple asphyxiants which are not known to cause adverse health effect, other than through reducina oxvaen levels in the air, do not have exposure limits and are not included in Table 5-4. As noted in section **5.56.** simple asphyxiants must not be allowed to create oxvaen deficient conditions.

EXPLANATION OF HEADINGS AND DESIGNATIONS

Chemical names

The chemical names used in the first column of the table are based orimarilv on the aeneric chemical names of the substance. Cross references, shown in italics, are provided for some chemicals if more than one name is in common use. The letters (RT) in brackets indicates a reaistered trademark. Substances are listed alphabetically by chemical name. Numerals and prefixes, for example, 1,2,3, tert, o-, sec-, cis, are disreaarded in determinina alphabetical order. Footnotes referenced in this column provide additional substance specific information located at the end of the table.

CAS number

Column **2** provides, if available, the Chemical Abstracts Service (CAS) registry number. If a substance has more than one **CAS** number associated with it, for example, inorganic lead and compounds, the **CAS** number associated with the parent compound is used.

Units

Column 3 identifies the units in which exposure limits are reported. Aerosols (dust, fumes, mists) and mixtures are typically reported in milliarams per cubic metre (mg/m^3). Pure vapours and gases are reported in parts per million (ppm). Substances where the predominant exposure is to a fibre are reported in fibres Der millilitre (f/ml).

The exposure limit (EL) for gases and vapours can be converted between ppm and mg/m^3 as follows:

$$\text{EL in } mg/m^3 = \frac{(\text{EL in ppm}) \times (\text{gram molecular weisht of substance})}{}$$

Exposure limits

Columns **4** through **6** indicate, resoectivelv. the 8-hour exposure limit, 15-minute exposure limit and ceilina limit.

Desianations

The last column provides information on whether skin absorption is a significant route of exposure, and toxicoloaical desianations associated with each substance. In some cases, substances are provided with **a** desianation onlv. and **do** not have numerical exposure limits, Specific requirements reaardina the handlina and use of such substances must be followed. Desianations are as follows:

Skin: The skin desianation indicates that skin absorption can contribute to the overall exposure.

Carcinouens:

K1 -- a confirmed human carcinogen:

K2 -- a suspected human carcinoaen;

K3 -- a possible human carcinoaen.

Reproductive toxins:

R1 -- a proven reproductive toxin:

R2 -- a possible reproductive toxin.

Sensitizers: These substances, identified bv the letter **Z,** have been shown to produce an alleraenic type of response in some workers after an initial exposure, resultina in the development of symptoms upon subseauent exposure at much lower concentrations.

ALARA substances: These are substances to which exposure of workers must **be** kept as low as reasonablv achievable. They are desianated in Table **5-4** with the letter **A.**

Chemical Name	CAS Number	Unit	hour EL	minute EL	Ceiling Designation
ABATE, RESPIRABLE DUST	3383-96-8	mg/m³	3		
ABATE, TOTAL DUST	3383-96-8	mg/m³	10	20	
ACETALDEHYDE	75-07-0	ppm			
ACETAMIDE	60-35-5				K3
ACETIC ACID	64-19-7	ppm	10	15	
ACETIC ANHYDRIDE	108-24-7	DDm			
ACETONE	67-64-1	ppm	250	500	
ACETONE CYANOHYDRIN	75-86-5	ppm			

1 SKIN				
ACETONITRILE	75-05-8	ppm	20	60
ACETOPHENONE	98-86-2	ppm	10	
ACETYLENE DICHLORIDE, see *1,2-DICHLOROETHYLENE*				
ACETYLENE TETRABROMIDE	79-27-6	ppm	1	1.5
ACETYLSALICYLIC ACID	50-78-2	mg/m³	5	
R2				
ACROLEIN	107-02-8	ppm	0.1	0.3
SKIN				
ACRYLAMIDE	79-06-1	mg/m³	0.03	
SKIN, K2				
ACRYLIC ACID	79-10-7	ppm	2	
SKIN				
ACRYLONITRILE	107-13-1	ppm	2	
SKIN, K2				
ADIPIC ACID	124-04-9	mg/m³	5	
ADIPONITRILE	111-69-3	ppm	2	
SKIN				
ALDRIN	309-00-2	mg/m³	0.25	0.75
SKIN				
ALLYL ALCOHOL	107-18-6	ppm	2	4
SKIN				
ALLYL AMINE	107-11-9	ppm	2	
SKIN				
ALLYL CHLORIDE	107-05-1	ppm	1	2
SKIN				
ALLYL GLYCIDYL ETHER	106-92-3	ppm	5	10
SKIN, Z, A				
ALLYL PROPYL DISULFIDE	2179-59-1	ppm	2	3
ALUMINUM HYDROXIDE, RESPIRABLE DUST	21645-51-2	mg/m³	3	
ALUMINUM HYDROXIDE, TOTAL DUST	21645-51-2	mg/m³	10	
ALUMINUM OXIDE, RESPIRABLE DUST, AS Al_2O_3	1344-28-1	mg/m³	3	
ALUMINUM OXIDE, TOTAL DUST, AS Al_2O_3	1344-28-1	mg/m³	10	20
ALUMINUM, ALKYL COMPOUNDS, AS Al	7429-90-5	mg/m³	2	
ALUMINUM, PYRO POWDERS, AS Al	7429-90-5	mg/m³	5	
ALUMINUM, RESPIRABLE DUST, AS Al	7429-90-5	mg/m³	3	
ALUMINUM, SOLUBLE COMPOUNDS, AS Al	7429-90-5	mg/m³	2	
ALUMINUM, TOTAL DUST, AS Al	7429-90-5	mg/m³	10	
ALUNDUM, see *ALUMINUM OXIDE*				
4-AMINODIPHENYL (see note 1)	92-67-1			
SKIN, K1, A				
2-AMINOETHANOL, see ETHANOLAMINE				
2-AMINOPYRIDINE	504-29-0	ppm	0.5	2
AMITROLE	61-82-5	mg/m³	3.2	
K3				
AMMONIA	7664-41-7	ppm	25	35
50				
AMMONIUM CHLORIDE, FUME	12125-02-9	mg/m³	10	20
AMMONIUM PERFLUOROOCTANOATE	3825-26-1	mg/m³	0.01	
SKIN				
AMMONIUM SULFAMATE, RESPIRABLE DUST	7773-06-0	mg/m³	3	
AMMONIUM SULFAMATE, TOTAL DUST	7773-06-0	mg/m³	10	*20*
n-AMYL ACETATE	628-63-7	DDm	100	150
sec-AMYL ACETATE	626-38-0	DDm	125	153
ANILINE AND HOMOLOGUES	62-53-3	ppm	2	
SKIN				
ANISIDINE, o AND p- ISOMERS		mg/m³	0.5	
SKIN, K3				
ANTIMONY AND COMPOUNDS, AS Sb	7440-36-0	mg/m³	0.5	
ANTIMONY TRIOXIDE, AS Sb	1327-33-9	mg/m³	0.5	
K2				
ANTU	86-88-4	mg/m³	0.3	0.9
ARSENIC, ELEMENTAL, AND INORGANIC COMPOUNDS, AS As	7440-38-2	mg/m³	0.01	
K1, A				
ARSINE	7784-42-1	ppm	0.05	

Saskatchewan
Labour

Occupational Health
and Safety

Chemical and Biological SUbstances Guide

March 2001

Table of Contents

March 2001

Introduction

Part XXI of ***The Occupational Health and Safety Regulations,*** 1996 places duties on the employer to protect workers from the hazards of chemical and biological substances. Part XXII deals with the employer's duty regarding substances regulated by the Workplace Hazardous Materials Information System (WHMIS). Section ***85,*** Part VI of the regulations lists additional requirements to protect workers from biological substances that are known or suspected of causing infection in humans. The employer must address all these requirements, where they apply.

Chemicals have obvious uses and applications in chemical laboratories, in chemical production and in other chemical processes. They are also ingredients of trade name products such as paints, adhesives, photographic developers, and cleaners that are used in the workplace. Workers in food processing, sewage work, laboratories, agriculture, etc., handle biological substances or products containing biological substances of animal, plant or microbial origin.

Sometimes workers do not use, produce or handle chemical and biological substances directly, but are exposed to them when the substances are released into the workplace (for example, from processes such as welding, running equipment, oil-drilling and servicing, sawing or grinding).

Health care workers, emergency workers, animal handlers, sewage workers and others may also be exposed to **infectious** biological substances when they deal with infected persons, animals or infectious materials at work.

Hazardous substances may be released from structural materials such as insulation, new carpeting and furniture. Bacteria and fungi may grow on moist furnishings and structural materials in the workplace and even in water in ventilation systems. These microorganisms, and in some cases their spores, toxins and other products, can be released into the workplace air.

Workers may also be exposed to chemicals being stored or chemicals that have spilled, leaked or accumulated.

Chemical and biological substances may pose one or more of the following hazards:

- Fire – Flammable or combustible chemicals can bum under certain circumstances. Oxidizing chemicals can promote burning.

- **Explosions** – Compressed gases and liquids, reactive substances, etc. can explode under certain circumstances.

- **Toxic reactions** – Certain chemical and biological substances (e.g., bacterial toxins, mycotoxins) can be fatal or cause illness or injury if they are inhaled or enter the body by other means. The effects may occur within a short time of the exposure (acute effect) or after repeated exposures over a relatively long period, such as weeks, months or years (chronic effect). An effect may clear up within a short time, be permanent or persist for a long time (long term effect).

- **Burns** – Certain substances can cause severe eye, skin and airway irritation or damage.

- **Sensitization** – Certain chemical and biological substances (e.g., spores and bacterial enzymes) can cause skin or respiratory allergies or other sensitivity reactions.

- **Infection** – Some bacteria, viruses, fungi and parasites can be transmitted to workers and cause infectious diseases.

- **Dangerous reactions** – Reactive chemicals are unstable under certain conditions or can react with other chemicals to produce fires, explosions or toxic products.

General requirements

The general duties of the employer for controlling the risks associated with chemical and biological substances are listed in section 302 of *The Occupational Health and Safety Regulations, 1996*. The following is a guide to how employers address these duties.

- Find out what chemical and biological substances in the workplace have hazardous properties and examine their use and presence. Determine which of these substances may harm workers considering the properties of the chemicals and how workers are exposed to them.

- List all chemical and biological substances that may be hazardous to workers. This includes hazardous substances used, handled, stored, produced or disposed of during work processes and other substances workers are concerned about. Keep the list up to date. Consult with the occupational health committee, the worker health and safety representative (representative), or the workers (where there is no occupational health committee or representative) in preparing and updating the list. Identify substances on the list that are subject to WHMIS requirements.

- Assess the risk from exposure to these chemical and biological substances. Sources of information include Material Safety Data Sheets (MSDSs) and other supplier information, industry experience, including any results of monitoring done in similar situations, workers' concerns, regulatory requirements and safety organizations' information.

- If, based on the risk assessment, you suspect that the extent of exposure may cause harm to workers, consider and take all practicable (possible) steps to prevent workers from being exposed to that extent.

- Check whether any of the more hazardous substances that are in use can be eliminated or if there are less hazardous substitutes. Use suppliers' information and industry experience. As far as is reasonably practicable, substitute with the less hazardous substances.

- Examine the extent of contamination of the workplace with hazardous substances (including the work environment, work surfaces and workers' bodies). Investigate and implement reasonably practicable measures to reduce contamination.

- Develop and implement safe work procedures and processes for handling, using, transporting, storing, producing and disposing of chemical and biological substances. Integrate safety into all procedures and work processes and develop any necessary additional safe work procedures and processes.

- Inform workers of how individual chemical and biological substances can cause harm and the type and degree of harm that can result. Develop training in consultation with the occupational health committee or the representative. Training must include the risks associated with the substances, how to reduce exposure and protect workers, and what to do when there are mishaps with the substances.

WHMIS duties

Employers' duties under the Workplace Hazardous Materials Information System (WHMIS) are described in Part XXII of *The Occupational Health and Safety Regulations, 1996*. Products controlled under WHMIS (controlled products) cannot be used, but may be kept in storage at the workplace until these duties have been met (such as providing correct labels and product identifiers, Material Safety Data Sheets (MSDSs) and worker training).

Substances that meet the hazard criteria described in the federal *Controlled Products Regulations* (Canada) are "controlled products" and subject to WHMIS requirements. The Occupational Health and Safety Division publication *WHMIS Controlled Products* will assist employers and workers in recognizing controlled products. (See the Saskatchewan Labour website at www.labour.gov.sk.ca or contact the Division at 1-800-567-7233 for this, and other resources.) Products that readily bum or explode, or produce toxic reactions, allergies, infectious diseases or dangerous reactions are likely to be controlled products. Check the labels and MSDSs for hazard warnings.

The employer must develop and implement a system to obtain and update the required hazard information (MSDSs and labels) and use it to establish safe work procedures and worker training. Particular workers, positions or departments should be assigned responsibilities in the system. **A** competent person(s) must keep track of the flow of information and its use. **A** centralized ordering or receiving process will help ensure that the appropriate information is received. The occupational health committee or the representative should be consulted in setting up and auditing the system.

The system ensures that:

- An acceptable, current (less than three years old) MSDS is obtained at the time of purchase for each controlled product. The content of an acceptable MSDS is provided in sections 325 to 329 of the regulations.

- Out-of-date MSDSs must be substituted with current supplier MSDSs. When a supplier MSDS is unobtainable and the product is still in use, the employer must update the information on the MSDS.

- Relevant MSDSs are readily available to workers who need them. The availability requirement is provided in section 327 of the regulations.

- **A** correct WHMIS label (whether a supplier label or a workplace label) is attached to each container of a controlled product in the workplace(s). Labeling requirements are provided in sections 319 to 324 of the regulations.

- A training program is developed and delivered on the WHMIS system as well as on the hazards of controlled products, safe handling and emergency procedures where there are fugitive emissions present. The content of the training program and its objective are given in section 318 of the regulations and explained in the Division publication *WHMIS Worker Training Requirements.*

Hazardous products exempt from WHMIS

(section 304 of *The Occupational Health and Safety Regulations, 1996)*

Some hazardous products used in the workplace, such as consumer products, explosives, pesticides, drugs, cosmetics and radioactive substances, are exempt from requirements for WHMIS supplier labels and MSDSs. Hazardous waste is exempt from the MSDS requirements.

Employers are still required to collect and record the hazards of the above products and determine how to safely handle them. Containers of these products must be clearly labeled. Workers must be informed of the hazards and trained on the safe use of these products.

Employer duties for specific chemical and biological substances

Chemical and biological substances with assigned workplace contamination limits

(section 307 of *The Occupational Health and Safety Regulations, 1996)*

Workplace Contamination Limits (CLs) have been established for many workplace chemicals and some biological substances. Both 15 minute CLs and eight hour CLs are listed in Table 21 of the regulations.

The employer's duty is to ensure that workers are not exposed to average airborne concentrations of these substances that exceed the CLs. The employer must take all reasonably practicable steps to ensure that these limits are not exceeded in any area where a worker is usually present.

Airborne concentrations can be lowered by engineering controls that may include ventilation or using enclosures to prevent or minimize the release of the substance into the work environment.

In certain cases, it may not be reasonably practicable to use engineering controls. For example, the employer would not be expected to install a mechanical exhaust system to keep worker exposure below a CL if a substance is only used once a year in an annual maintenance procedure. In such cases the employer must provide alternative controls, such as appropriate personal protective equipment. (This is described in Part VII of the regulations).

The employer must address contamination of the work environment and determine the need, conditions and process for workplace monitoring. Monitoring (air sampling, personal assessment of exposure and so forth) measures contaminants in the workplace. Monitoring can help assess the risks faced and the adequacy of hazard controls.

Monitoring must be used when:

1. the work environment may not be safe because of:
   - lack of information about how badly the workplace is contaminated;
   - fluctuations in concentrations of contaminants;
   - variations in how often workers are exposed to contaminants; or,

2. workers have complained about their health, or may have become ill because of exposure(s) to workplace contaminants, and existing monitoring test results are suspect or unsatisfactory.

Monitoring is not required where there is no standard method of obtaining reliable results, or the results obtained with a standard method do not provide meaningful measures of risk

The eight hour CL may not be appropriate to protect workers who work extended shifts (more than eight hours a day) or work weeks (more than 40 hours) because of the larger cumulative dose received over a shorter time span. In these cases, the exposure should be limited to a proportion of the eight hour CL (such as $^{8}/_{12}$ of the CL for a 12-hour shift) unless there is adequate evidence that the lower limit is not justified.

Similarly, CLs are based on exposure to one chemical. In some cases a worker may be exposed to a combination or mixture of substances, each of which has a similar toxic effect when acting on the same body organ system (additive effect). A worker exposed to such a mixture can be exposed to each substance at a concentration below its respective CL, but can still be exposed to a hazardous concentration of the mixture. In these cases, the exposure limit (concentration) for each substance must be limited to a fraction of its respective CL.

In situations of an extended shift or possible additive effect, the employer is required to develop and implement, in consultation with the committee, an appropriate written work procedure that limits the risk to the workers. The procedure must identify:

- substances workers may be exposed to
- conditions under which workers will be required or permitted to work, including the frequency and duration of exposure to the substances
- steps the employer will take to ensure no worker's personal exposure exceeds the equivalent of the CL

Notifiable and designated substances

(sections 305, 306, 311 of *The Occupational Health and Safety Regulations, 7996)*

A number of chemical and biological substances are listed in Table 19 of the regulations as *Notifiable Substances* because of the serious nature of the hazards associated with them. Most of these are synthetic chemicals known to **cause cancer** in humans. The employer must notify the Director of the Occupational Health and Safety Division and obtain written permission and a statement of the conditions of use before the substance is handled, used, produced, distributed or disposed of at the place of employment.

Chemicals that have been identified as **possible or probable causes of cancer** in humans have been identified in Table 20 of the regulations as *Designated Substances.* Where workers are required to handle, use, store, produce or dispose of any of these chemicals, the employer must provide engineering controls, such as local ventilation or enclosures, to prevent the chemical and biological substances from being released into the workplace. The employer must also implement other measures, such as administrative measures and use of personal protective equipment, to prevent workers from being exposed to the substance to an extent that poses any significantly greater risk of disease than persons not so exposed.

Employer duties for certain workers

(section *308* of *The Occupational Health and Safety Regulations, 7996)*

Pregnant workers and workers who are hypersensitive or unusually responsive to a substance may require additional protection. If there is a substance present in a form and to an extent that may harm these workers, and the worker notifies the employer of their condition or their response to the substance, the employer must take steps to minimize the exposure.

The worker may ask to be assigned to less hazardous, alternate work. If the worker's exposure cannot be minimized in their current position with reasonable measures, the employer must assign the worker to less hazardous, alternate work, if available.

In some cases, after taking the above steps, the employer may still not be able to completely protect the worker. In such cases, the employer is not usually expected to take further action.

Safe storage of flammable, unstable, highly reactive and corrosive substances

(section **314** of *The Occupational Health and Safety Regulations, 1996*)

Where storage of these substances may put workers at risk, the employer **must** ensure the substances are stored in contained and enclosed areas, isolated from work areas to the extent that minimizes the risk to workers. Storage areas must be adequately ventilated and identified as described in section 314 of the regulations.

Where two or more chemical substances, when combined, produce a toxic, corrosive or explosive reaction, the employer shall ensure that the substances are effectively separated and stored to prevent the substances from combining.

Emergency preparedness and response

(section 310 of *The Occupational Health and Safety Regulations, 1996)*

When reviewing substances in a workplace, the employer must consider possibilities for accidental spills, leaks and accumulations of substances that could be hazardous. Employers must prepare in advance for such accidents. In consultation with the committee, the employer must develop written emergency procedures. Employers must train workers on the procedures and ensure that emergency supplies and equipment are available.

If a worker could be asphyxiated or poisoned at work, the employer must make arrangements to rescue workers and treat such conditions, and make sure any antidotes, first aid and medical treatments are available. Employers must also determine the need to provide emergency eyewashes and showers.

Infectious substances

(section 85 of *The Occupational Health and Safety Regulations, 1996*)

To protect workers who are likely to be exposed to infectious materials or organisms (listed in Table **14** of the regulations), the regulations require the employer to develop and implement a written plan. The plan must be developed in consultation with the occupational health committee. The plan must:

- identify workers who may be at risk of exposure
- describe risks associated with the exposure
- describe infection control measures

- set out the procedures to be followed in cases of spills or leaks
- set out the procedures to be followed in cases of accidental exposures
- set out the procedures to be followed where a worker believes that he or she has been exposed
- set out the methods of cleaning, disinfecting or disposing of contaminated material
- describe the training that will be provided to workers
- require the investigation and documentation of exposure incidents
- require the investigation of **any** associated infection or disease occurrence

Where a worker has been exposed to blood or infectious body fluids, the employer is required to take follow-up actions. These actions include evaluating and assessing the extent of the exposure. For harmful exposures, follow-up actions include malting arrangements for confidential post-exposure counseling, medical evaluation or medical intervention by a qualified person in a manner that is acceptable to the Department of Health. These follow-up actions are provided at the request of the worker **and** must be conducted during the worker's normal working hours or the worker's post-exposure follow-up time must be credited as time at work.

Accidents involving hazardous substances

Accidents involving a hazardous chemical or biological substance that:

- result in death,
- may have resulted in death, or
- result in hospitalization for more than **24** hours

must be investigated (section 29 of *The Occupational Health and Safety Regulations, 1996).* The co-chairpersons of the occupational health committee do the investigation. If there is no occupational health committee, the representative and the employer investigate. Where there is neither a committee nor a representative, the employer investigates. **A** written report of the accident must be prepared that includes results of the investigation and items listed in section 29(2) of the regulations.

The Occupational Health and Safety Division must be notified of accidents caused by chemical or biological substances that result, or could have resulted, in worker death or hospitalization of the worker for more **than 72** hours.

If a worker is exposed to a substance listed in Table 19 or 20 of **the** regulations that spilled, leaked or accumulated, the employer, in consultation with the committee, must investigate the exposure and provide a written report on the investigation to the worker and the committee. Section **311 of** the regulations lists the content of the investigation report.

Appendix

Workplace contamination limits

These tables were derived from Table 21 of ***The Occupational Health*** *and Safety Regulations, 1996.*

Concentrations can often be measured by instruments that determine the quantity of a substance in a known volume of air. In Table 21 of the regulations, the concentrations are expressed as the weight of a substance in milligrams per cubic metre (mg/m^3) of air. Concentrations of many gases and vapours are measured and expressed as parts (volume) of the substance in a million parts (volumes) of air (ppm). This table lists both concentration units.

Each of the two means of expressing concentrations can be converted to the other. This is often necessary when an instrument expresses a concentration in terms of ppm and this value must be compared with a contamination limit (CL) in Table 21 which lists the limits in mg/m^3 of air.

- **To convert ppm to mg/m^3, use:**

$$C\ (mg/m^3) = C\ (ppm) \times GMW\ (substance) / 24.45$$

- **To convert mg/m^3 to ppm, use:**

$$C\ (ppm) = C\ (mg/m^3) \times 24.45 / GMW\ (substance)$$

Where:

- ***C*** (mg/m^3) is the concentration expressed as the weight of the substance in a known volume of air
- ***C*** (ppm) is the concentration expressed as the number of parts (volume) of a substance in a million parts (volumes) of air
- **GMW** (substance) is the gram molecular weight of a substance which can be found in chemistry texts or handbooks or in a Periodic Table
- mg/m^3 means milligrams per cubic metre
- **ppm means** parts per million
- **24.45** is the molar volume of air in litres at normal temperature and pressure conditions (25°C at normal atmospheric pressure [760 torr])

Workplace Contamination Limits

CAS Number	Substance	8 hour average contamination limit mg/m³*	8 hour average contamination limit ppm*	15 minute average Contamination limit mg/m³*	15 minute average contamination limit ppm*
75-07-0	Acetaldehyde	**C45	**C25	—	—
64-19.7	Acetic acid	25	10	37	15
108-24-7	Acetic anhydride	20	S	30	7
67-64-1	Acetone	1780	750	2380	1000
75-86-5	Acetone cyanohydrin, (as CN)	**C5	* T I 44	—	—
75-05-8	Acetonitrile	67	40	101	60
98-8&2	Acetophenone	49	10	74	IS
79-27-6	Acetylene tetrabromide	14	1	21	1.5
50-78-2	Acetylsalicylic acid	5	—	I0	
107-02-8	Acrolein	0 23	0 1	0 7	0 3
79-061	Acrylamide	0 03	—	0 09	—
79-10-7	Acrylic acid	5 9	2	12	4
107-13-1	Acrylonitrile+*	4 3	2	8 6	4 0
124-04-9	Adipic acid	5	—	10	—
111-69-3	Adiponitrile	8 8	—	17 6	—
309-00-2	Aldrin	025	—	0 75	—
107-18-6	Allyl alcohol	4 8	2	9 5	4
107-05-1	Allyl chloride	3	1	6	
106-92-3	Allyl glycidyl ether (AGE)	23	5	47	10
2ii9-59-I	Allyl propyl disulfide	I2	2	18	3
—	Aluminum metal and oxide, (as AI)	I0	—	20	—
—	Aluminum pyro powders, (as AI)	5	—	10	—
—	Aluminum welding fumes, (as AI)	5	—	I0	—
—	Aluminum, soluble salts, (as AI)	2	—	4	—
—	Aluminum, alkyls, (ar AI)	2	—	4	—
141-43-5	2-Aminoethanol (Ethanolamine)	7.5	3	15	6
504-29-0	2-Aminopyridine	19	OS	4	I
766441-7	Ammonia	17	2s	24	35

* *mg/m³ = milligrams of substance per cubic metre of air; ppm = parts per million*
** *C denotes ceiling limit*
+* *This entry differs slightly from the corresponding entry in the regulations There was a typographic error in the regulations that will be corrected in a future printing*
\+ see *note at end of Table*
++ *not otherwise classified*

Workplace Contamination Limits

CAS Number	Substance	8 hour average contamination limit mg/m³*	8 hour average contarnination limit ppm*	15 minute average contamination limit mg/m³*	15 minute average contamination limit ppm*
12125-02-9	Ammonium chlonde; fume	1o	--	20	---
3825-26-1	Ammonium Perfluorooctanoate	0.I	--	0.3	---
7773-06-0	Ammonium sulfamate (Ammate)	I0	--	20	---
628-63-7	n-Amyl acetate	532	100	665	I25
626-38-0	sec-Amyl acetate	665	125	831	156
62-53-3	Aniline and homologues	7.6	2	IS	4
---	Anisidine (o-, p-isomers)	0.5	0.1	I.5	0.3
7440-36-0	Antimony and compounds, (as Sb)	0.5	---	I.5	---
86-88-4	ANTU (a-Naphthyl thiourea)	0 3	---	0.9	---
7440-38-2	Arsenic, elemental, and inorganic compounds except arsine, (as As)	0.0I	---	0.03	---
7784-42-1	Arsine	016	0.05	0.48	0 IS
8052-42-4	Asphalt (petroleum) fumes	5	---	I0	--
1912-24-9	Atrazine	5	---	10	---
86-50-0	Artnphos-methyl	0.2	---	0 6	---
7440-39-3	Barium, soluble compounds, (as Ba)	0.5	---	I.5	---
17804-35-2	Benomyl	10	---	20	---
106-51-4	p-Benzoquinone (Qwone)	0.4	0.I	I.2	0 3
98-88-4	Benzoyl chlonde	**C2 8	**C0 5	---	---
94-36-0	Benzoyl peroxide	S	—	10	---
I40-II-4	Benzyl acetate	61	10	I22	20
I00-44-7	Benzyl chloride	5.2	I	10.4	2
7440-4 1-7	Beryllium and compounds. (as Be)	0.002	---	0.01	---
92-52-4	Biphenyl (diphenyl)	1.3	0.2	4	0.6
1304-82-1	Bismuth telluride	10		20	
1304-82-1	Bismuth telluride, Se-doped	5	---	10	---

* *mg/m³ = milligrams of substance per cubic metre of air; ppm = parts per million*
** *C denotes ceiling limit*
+* *This entry differs slightly from the corresponding entry in the regulations. There* was *a typographic error in the regulations that will be corrected in a future printing*
\+ *see note at end of Table*
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CAS Number	Substance	8 hour average contamination limit mg/m³*	8 hour average contamination limit ppm*	15 minute average contamination limit mg/m³*	15 minute average contamination limit ppm*
1314-13-2	Zinc oxide dust	10	--	20	----
7440-67-7	Zirconium and compounds, (as Zr)	5	---	lo	--

+ Sote: For the application of this limit, respirable sire is that fraction of dust passing in a size selector with the following characteristics:

Aerodynamic Diameter (μm) (unit density sphere)	*% Passing selector*
0	100
1	97
2	91
3	74
4	*50*
5	30
6	17
7	*9*
8	5
10	1

* *mg/m³ = milligrams of substance per cubic metre of air: ppm = parts per million*
** *C denotes ceiling limit*
+* *This entry differs slightly from the corresponding entry in the regulations There was a typographic error in the regulations that will be corrected in a future printing*
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Resources

Occupational Health and Safety Division publications related to chemicai and biological substances

To obtain any of the following publications, please visit the Saskatchewan Labour website, www.labour.gov.sk.ca, or call the Occupational Health **and** Safety Division toll free at 1-800-567-7233.A number of videos may also be borrowed Free of charge in Saskatchewan. Please see the website or contact us for details.

Bulletins

Abrasive Blasting
Applying Pesticides Inside Places of Employment: Responsibilities of Applicators, Employers and Owners
Cutting Metals With Gas Plasma
Flammable hydrocarbon mixtures as freon substitutes in vehicle air-conditioning systems
Mercury and Dental Worlcers
PCBs in Light Ballasts
Plumbers and PVC Pipe Glue
Requirements for Handling Glasswool (fibreglass) Insulation
Saskatchewan Arena Air Quality Program
Spraying of Isocyanate Paints and Primers
Worker Burned ... Bulk Storage Facility
Worker Drowns After Exposure to H_2S
Worker Overcome By H_2S While Working With Brine Water Containing Mineral Acid

WHMIS Bulletins

Distributors' Duties Under WHMIS
Getting a WHMIS Program Started
Importing Controlled Products
Selling Controlled Products to **Farms**
WHMIS: Controlled Products
WHMIS: How it Affects You
WHMIS: Role of the Occupational Health Committee or Representative
WHMIS and Consumer Products
WHMIS **and** Lab Chemicals
WHMIS Worker Training Requirements

Brochures/Booklets

Anhydrous Ammonia Hazard Information for Fanners
Commercial Pesticide Operators (Guidelines for)
Cytotoxic Drugs
Emergency Showers and Eyewashes
First Aid in Saskatchewan Workplaces
Hantavirus Disease: A Guide for Protection of Workers and the Public
Lab Chemical Storage
Latex and other glove use in health care (Guidelines for)
Lead Poisoning in Radiator Repair Shops
Medical Monitoring of Vehicle Repair Shop Workers Exposed to Inorganic Lead
Monitoring Exposure to Organophosphorus and/or Carbamate Insecticides
Monitoring Silicosis (Guidelines for)
Pesticide Container Recycling
Pesticide Safety Handbook
Pregnant Women and the Hazards of Workplace Chemicals (technical backgrounder)
Protecting Emergency Response Workers From Infectious Diseases
Smoking Regulations Guide

PROPOSED REVISED AND NEW ONTARIO OCCUPATIONAL EXPOSURE LIMITS

(See definitions and symbols key at the end of the table)

Remarque : Cette publication spéciale intitulée "Proposed Revised and New Ontario Occupational Exposure Limits" n'est disponible qu'en anglais. Conformément au Règlement 441/97, qui exige l'application de la Loi sur les services en français aux documents spécifiques, veuillez communiquer avec le ministère du Travail au (416) 326-1407 ou par courrier électronique : weblab@gov.on.ca

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SUBSTANCE	TWAEV				STEV				CEV			
	Proposed		Current		Proposed		Current		Proposed		Current	
	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³
Acetaldehyde [75-07-0]			100	180			150	270	25			
Acetone [67-64-1]	500		750	1780	750		1000	2375				
Acetone cyanohydrin [75-86-5], as CN*									4.7			
Acetophenone [98-86-2]*	10											
Acrolein [107-02-8]			0.1	0.23			0.3	0.7	0.1			
Acrylic acid [79-10-7]	2		10	29								
Adipic acid [124-04-9]*		5										
Adiponitrile [111-69-3]*	2											
Allyl Alcohol [107-18-6]	0.5		2	5			4	10				
Ammonium perfluoro-octanoate [3825-26-1]		0.01		0.1								
tert-Amyl methyl ether [994-05-8]†	250	1045			310	1295						
Asbestos fibres - Other than amosite and crocidolite [1332-21-4]	0.1 f/cc		1.0 f/cc								5.0 f/cc	
Benzaldehyde [100-52-7]†					4	17						
Benzene [71-43-2]	0.5		5	16	2.5						15	48
Benzotrichloride [98-07-7]*									0.1			
Benzoyl chloride [98-88-4]*									0.5			
Benzyl acetate [140-11-4]*	10											
Beryllium and its compounds (as beryllium) [7440-41-7]		0.002		0.002		0.01						
Bis[2-(Dimethylaminoethyl)] ether [3033-62-3]†	5	33										
Bis(Dimethylthiocarbonyl)disulfide [137-26-8]		1		5								
Bromacil [314-40-9]		10	1	11								
Bromine [7726-95-6]	0.1		0.1	0.7	0.2		0.3	2				
1,3-Butadiene [106-99-0]	2		10	22								
2-Butoxyethanol [111-76-2]	20		25	120								
2-Butoxyethyl acetate [112-07-02]†	20											
n-Butyl acrylate [141-32-2]	2		10	52								
p-tert-Butyltoluene [98-51-1]	1		10	60			20	120				
Cadmium and its compounds (as cadmium) [7440-43-9]		0.01		0.02								
Cadmium, elemental, and compounds, as Cd, Respirable [7440-43-9]*		0.002										
Calcium Chloride [10043-52-4]†		5										
Calcium chromate [13765-19-0], as Cr*		0.001										
Carbon monoxide [630-08-0]	25		35	40			400	460				
Charcoal, except activated [16291-96-6]†		10										
Chlorine [7782-50-5]	0.5		1	3	1		3	9				
Chloroacetone [78-95-5]*									1			
Chloroacetyl chloride [79-04-9]	0.05		0.05	0.23	0.15							
o-Chlorobenzaldehyde [89-98-5]†					4	23						

PROPOSED REVISED AND NEW ONTARIO OCCUPATIONAL EXPOSURE LIMITS

(See definitions and symbols key at the end of the table)

SUBSTANCE	TWAEV				STEV				CEV			
	Proposed		Current		Proposed		Current		Proposed		Current	
	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³	ppm	mg/m³
Trimethylamine [75-50-3]	5		10	24	15		15	36				
Trixylyphosphate [25155-23-1]†		0.1										
Vinyl acetate [108-05-4]	10		10	35	15		20	70				
Vinyl bromide [593-60-2]	0.5		5	22								
Vinyl chloride [75-01-4]	1		2	5.2							10	26
4-Vinyl cyclohexene [100-40-3]*	0.1											
Vinyl fluoride [75-02-5]*	1											
Vinylidene fluoride [75-38-7]*	500											
Wheat Flour Dust (total dust)†		3										
Wood Dust, not otherwise classified (total dust)†		3										
Zinc chromates, (13530-65-9; 11103-86-9;37300-23-5) as Cr*		0.01										

Footnotes

TWAEV (time-weighted average exposure value) is the average of the airborne concentrations of a biological or chemical agent determined from air samples of the airborne concentrations to which a worker is exposed in an 8-hour work day or a 40-hour work week.

STEV (short-term exposure value) is the maximum airborne concentration of a biological or chemical agent to which a worker is exposed in any fifteen minute period determined from a single sample or a time-weighted average of sequential samples taken during such a period.

CEV (ceiling exposure value) is the maximum airborne concentration of a biological or chemical agent to which a worker is exposed at any time.

ppm - The airborne concentrations of the agent are expressed as parts of the agent per million parts of air by volume.

mg/m3 - The airborne concentrations of the agent are expressed as milligrams of the agent per cubic metre of air.

f/cc - The airborne concentrations of the agent are expressed as fibres of the agent per cubic centimetre.

* New limits adopted from the 1999 American Conference of Governmental Industrial Hygienists (ACGIH) Threshold Limit Values (TLVs)

† New limits adopted from the Ontario Working Exposure Guidelines (WEGs)

◊ Provided that the total dust contains less than 0.7% vanadium.

¥ Provided that the respirable dust concentration does not exceed 2 mg/m3.

‡ For assessing the visibility in a work environment where 1.2-propylene glycol aerosol is present.

§ The value is for particulate matter containing no asbestos and less than 1% crystalline silica.

• A secondary WEG-TWAEV of 5 mg/m3 (total dust) is recommended to deal with dusty operations where fibre counts are usually difficult to determine. Where both types of measurements are made simultaneously, the more restrictive WEG-TWAEV should be used to assess the exposures.

INCHEM

Exposure limits:

Country / Effects	M	Time	TWAppm	TWAmg	STELppm	STELmg
*** ABATE						
CAS: 3383-96-8		RTECS: TF 6890000				
- BELGIUM			-	10	-	-
*** ACETALDEHYDE						
			100	180	150	270
*** ACETIC ACID						
CAS: 64-19-7		RTECS: AF 1225000				
			10	25	15	37
*** ACETIC ANHYDRIDE						
CAS: 108-24-7		RTECS: AK 1925000				
			-		*5	*21
*** ACETONE						
CAS: 67-64-1		RTECS: AL 3150000				
			750	1780	1000	2380
*** ACETONITRILE						
CAS: 75-05-8		RTECS: AL 7700000				
			40	67	60	101
SK						
*** 2-(ACETYLAMINO) FLUORENE						
CAS: 53-96-3		RTECS: AB 9450000				
			-	-	0	0
C1						
cs* ACETYLENE						
CAS: 74-86-2		RTZCS: AO 9600000				
ASP						
*** o-ACETYLSALICYLIC ACID						
CAS: 50-78-2		RTECS: VO 0700000				
			-	5	-	-
*** ACROLEIN						
CAS: 107-02-8		RTECS: AS 1050000				
			0.1	0.23	0.3	0.69
*** ACRYLAMIDE						
CAS: 79-06-1		RTECS: AS 3325000				
			-	0.03	-	-
C2,SK						
*** ACRYLIC ACID						
CAS: 79-10-7		RTECS: AS 4375000				
			10	23	-	-

000236

*** ACRYLONITRILE
CAS: 107-13-1 RTECS: AT 5250000
2 4.3 - -
C2,SK

*** ALDRIN
CAS: 309-00-2 RTECS: IO 2100000
- 0.25 - -
SK

*** ALLYL ALCOHOL
CAS: 107-18-6 RTECS: BA 5075000
2 4.8 4 9.5
SK

*** ALLYL PROPYL DISULFIDE
CAS: 2179-59-1 RTECS: JO 0350000
2 12 3 18

*** 1-ALLYL-2,3-EPOXYPROPYL ETHER
CAS: 106-92-3 RTECS: RR 0875000
5 23 10 47
SK

*** ALUMINUM
CAS: 7429-90-5 RTECS: BD 0330000
- 10 - -

*** ALUMINUM (fumes) (as Al)
- 5 - -

*** ALUMINUM (pyro powders)
- 5 - -

*** ALUMINUM ALKYL COMPOUNDS (as Al)
RTECS: BD 0330000
- 2 - -

*** ALUMINUM CCMPOUNDS (soluble) (as Al)
- 2 - -

*** ALUMINUM OXIDE
CAS: 1344-28-1 RTECS: BD 1200000
- 10(id) - -
CAS: 299-86-5 RTECS: TB 3850000
- 5 - 20

*** 4-AMINODIPHENYL
CAS: 92-67-1 RTECS: DU 8925000
- - 0 0
C1,SK

*** 2-AMINOPYRIDINE
CAS: 504-29-0 RTECS: US 1575000
0.5 2 - -

*** AMITROLE
CAS: 61-82-5 RTECS: XZ 3850000
- 0.2 - -

*** AMMONIA
CAS: 7664-41-7 RTECS: BO 0875000

000237

	25	17	35	24

*** AMMONIUM CHLORIDE (fumes)
CAS: 12125-02-9 RTECS: BP 4550000

-	10	-	20

*** AMMONIUM PERFLUOROOCTANOATE
CAS: 3825-26-1 RTECS: RH 0782000

-	0.1	-	-

*** AMMONIUM SULFAMATE
CAS: 7773-06-0 RTECS: WO 6125000

-	10	-	-

*** n-AMYL ACETATE

100	532	-	-

*** ANILINE
CAS: 62-53-3 RTECS: BW 6650000

2	7.6	-	-

SK

*** o-ANISIDINE
CAS: 90-04-0 RTECS: BZ 5410000

0.1	0.5	-	-

SK

*** p-ANISIDINE
CAS: 104-94-9 RTECS: BZ 5450000

0.1	0.5	-	-

SK

*** ANTIMONY COMPOUNDS (as Sb)
CAS: 1440-36-0 RTECS: CC 4025000

-	0.5	-	-

**+ NITIMONY HYDRIDE
CAS: 7803-52-3 RTECS: WJ 0700000

0.1	0.51		

*** ANTIMONY TRIOXIDE
CAS: 1305-64-4 RTECS: CC 5650000

-	0.5	-	-

CAS: 86-88-4 RTECS: YT 9275000

-	0.3	-	-

**+ ARGON
CAS: 7440-37-1 RTECS: CF 2300000

ASP

*** ARSENIC
CAS: 7440-38-2 RTECS: CG 0525000

-	0.2	-	-

*** ARSENIC COMPOUNDS (soluble) (as As)
CAS: 7440-38-2 RTECS: CG 0525000

-	0.2	-	-

*** ARSENIC TRIOXIDE
CAS: 1327-53-3 RTECS: CG 3325000

-	-	-	-

000238

c2

*** ARSINE
CAS: 7784-42-1 RTECS: CG 6475000
0.05 0.16 - -

*** ASPHALT (fumes)
CAS: 8052-42-4 RTECS: CI 9900000
- 5 - -

*** ATRAZINE
CAS: 1912-24-9 RTECS: XY 5600000
- 5 - -

*** AZINPHOS METHYL
CAS: 86-50-0 RTECS: TE 1925000
- 0.2 - -
SK

*** AZIRIDINE
CAS: 151-56-4 RTECS: KX 5075000
- - 0 0
SK

*** BARIUM COMPOUNDS (soluble) (as Ba)
CAS: 7440-39-3 RTECS: CQ 8370000
- 0.5 - -

*** BARIUM SULFATE (dust)
CAS: 7727-43-7 RTECS: CR 0600000
- 10(id) - -

*** BENOMYL
0.84 10 - -

*** BENZENE
10 32 - -
C2

*** BENZIDINE
CAS: 92-87-5 RTECS: DC 9625000
- - 0 0
C1,SK

*** BENZIDINE (production)
- - 0 0
C1

*** BENZIDINE SALTS
CAS: NOT AVAILABLE RTECS: -
- - 0 0
C1

*** BENZO(a)PYRENE
CAS: 50-32-8 RTECS: DJ 3675000
- - - -
C2

*** p-BENZOQUINONE
CAS: 106-51-4 RTECS: DK 2625000
0.1 0.44 - -

000239

*** BENZOYL PEROXIDE
CAS: 94-36-0 RTECS: DM 8575000
- 5 - -

*** BERYLLIUM
CAS: 7440-41-7 RTECS: DS 1750000
- 0.002 - -
C2

*** BERYLLIUM COMPOUNDS (as Be)
- 0.002 - -
c2

*** BIPHENYL
CAS: 92-52-4 RTECS: DU 8050000
0.2 **1.3** - -

*** BIS(2-CHLOROETHYL)ETHER
CAS: 111-44-4 RTECS: KN 0875000
5 29 **10** 58
SK

+ BIS(2-ETHYLHEXYL)PHTHALATE
CAS: 117-81-7 RTECS: TI 0350000
- 5 - 10

*** BIS(CHLOROMETHYL)ETHER
CAS: 542-88-1 RTECS: KN 1575000
0.001 0.0047 - -
C1

*** BISMUTH TELLURIDE
CAS: 1304-82-1 RTECS: EB 3110000
- 10 - -

*** BISMUTH TELLURIDE (selenium doped)
- 5 - -

**• BORNAN-2-ONE
CAS: 76-22-2 RTECS: EX **1225000**
2 12 3 19

.** BORON TRIBROMIDE
CAS: 10294-33-4 RTECS: ED 7400000
- - *1 *10

•** BORON TRIFLUORIDE
CAS: 7637-07-2 RTECS: ED 2275000
- - *1 *2.8

*** BROMACIL (ISO)
CAS: 314-40-9 RTECS: YQ 9100000
1 11 - -

*** BROMINE
CAS: 7726-95-6 RTECS: EF 9100000
0.1 **0.66** **0.3** 2

*** BROMINE PENTAFLUORIDE
CAS: 7789-30-2 RTECS: EF 9350000
0.1 0.72 - -

000240

*** 2-BROMO-2-CHLORO-1, 1, 1-TRI-FLUOROETHANE
CAS: 151-67-7 RTECS: KH 6550000

50	404	-	-

*** BROMOCHLOROMETHANE
CAS: 74-97-5 RTECS: PA 5250000

200	1058	250	1320

*** BRCMOETHANE
CAS: 74-96-4 RTECS: KH 6475000

200	891	250	1110

*** BROMOETHYLENE
CAS: 593-60-2 RTECS: KU 0400000

5	**22**	-	-

c2

*** BROMOFORM
CAS: 75-25-2 RTECS: PB 5600000

0.5	5.2	-	-

SK

*** SROMQMETHANE
CAS: 74-83-9 RTECS: PA 4900000

5	20	-	-

SK

*** BROMOTRIFLUOROMETHANE
CAS: 75-63-8 RTECS: PA 5425000

1000	6090	-	-

*** 1,3-BUTADIENE

CAS: 106-99-0 RTECS: EI 9275000

10	22	-	-

c2

*** BUTAN-1-OL
CAS: 71-36-3 RTECS: EO 1400000

-	-	*50	*152

SK

*** BUTAN-2-OL
CAS: 78-92-2 RTECS: EO 1750000

100	303	150	455

*** BUTAN-2-ONE
CAS: 70-93-3 RTECS: EL 6475000

200	590	300	085

*** n-BUTANE
CAS: 106-97-8 RTECS: EJ 4200000

800	1900	-	-

*** tert-BUTANOL
CAS: 75-65-0 RTECS: EO 1925000

100	**303**	150	**455**

*** BUTANONE PEROXIDE
CAS: 1330-23-4 RTECS: EL 9450000

-	-	*0.2	*1.5

*** 1-BUTOXYETHANOL

000241

Workplace Exposure Standards

Effective from 2001

Contents

Introduction

The following table contains an up-to-date list *of* the New Zealand Workplace Exposure Standards that replace the **1994** WES figures. When the complete document is published later in 2001 it will include:

Revised Biological Exposure indices.
Changes in the way WES are to **be** interpreted including adjustment to accommodate for unusual workshifts
A revised list of workplace standards compiled by other organisations.

	CAS No[a],	TWA ppm[b]	TWA mg/m³[c]	STEL ppm[b]	STEL mg/m³[c]
Acetaldehyde (2001)	[75-07-0]	20	-	50	
Acetic acid	[64-19-7]	10	25	15	37
Acetic anhydride	[loa-24-71	Ceiling 5ppm (21 mg/m³)			
Acetone	[67-64-1]	500	1,185	1,000	2,375
Acetonitrile (skin)	[75-05-8]	40	67	60	101
Acetylene	[74-86-2]	Simple asphyxiant-may present an explosion hazard,			
Acetylene dichloride (see 1,2-Dichloroethylene)					
Acetylene tetrabromide	[79-27-6]	1	14	-	-
Acetylsalicylic acid	[50-78-2]		5		
Acrolein	[107-02-8]	0.1	0.23		
Acrylamide (shin. A2)	[79-06-1]	-	0.03	-	
Acrylic acid (skin)	[79-10-7]	2	5.9	-	
Acrylonitrile (skin, A2)	[107-13-11	2	4.3	-	
Aldrin (skin)	[309-00-2]	-	0.25		
Allyl alcohol (skin)	[107-18-61	2	4.8	4	9.5
Allyl chloride	[107-05-1]	1	3.0	2	6.0
Allyl glycidyl ether (AGE) (skin. sen)	[106-92-3]	5	23	10	47
Allyl propyl disulfide	[2179-59-1]	2	12	3	18
a-Alumina (see Aluminium oxide)					
Aluminium, as Al	[7429-90-5]				
Metal dust			10		
Pyro powders		-	5		
Welding fumes			5		
Soluble salts		-	2		
Alkyls (Not otherwise classified)			2		
Aluminium oxide	[1344-28-1]	-	10[d]		
4-Aminodiphenyl (skin, A1)	[92-67-1]	-	-		
2-Aminoethanol (see Ethanolamine)					
2-Aminopyridine	[504-29-0]	0.5	2.0	-	
3-Amino-1,2,4-triazole (see Amitrole)					
Amitrole	[61-82-5]	-	0.2	-	
Ammonia	[7664-41-7]	25	17	35	24
Ammonium chloride fume	[12125-02-91	-	10	-	20
Ammonium perfluorooctanoate	[3825-26-1]	-	0.1	-	
Ammonium sulphamate	17773-06-01	-	10	-	-
Amosite (see Asbestos)					
n-Amyl acetate	1628-63-71	100	532	-	-
sec-Amyl acetate	1626-38-01	125	665	-	-
Aniline & homologues (skin. 2001)	[62-53-3]	1	4	-	

Notes to **WES table**

(a) CAS #,Chemical Abstracts Service Registry.A unique numbering identifier *is* assigned to each individual chemical.

(b) Parts of vapour or gas per million of contaminated air by volume at **25** °C and 760 torr.

(c) Milligrams of substance per cubic metre of air.

(d) The value is for inspirable dust containing no asbestos and less than 1%free silica.

(e) Fibres longer than 5mm and with an aspect ratio equal to or greater than 3:1 as determined by the membrane filter method.Asbestos levels can be changed by *Gazette* notice.

(g) Lint-free dust as measured by the vertical elutriator cotton-dust sampler described in the *Transactions of the National Conference on Cotton* ***Dust*** p.33,by J.R.Lynch (May 2,1970).

(i) A range of airborne contaminants are associated with gas and arc welding.The type of metal being welded,the electrode employed and the welding process will all influence the composition and amount of fume.Gaseous products such as oxides of nitrogen,carbon monoxide and ozone may also be produced.In the absence of toxic elements such as chromium,and where conditions do not support the generation of toxic gases,the fume concentration inside the welder's helmet should not exceed ***5*** mg/m^3.

(j) Sampled by a method that does not collect vapour.

(k) Thermal decomposition of polytetrafluoroethylene(PTFE,teflon)has been shown to cause polymer fume fever.Although the decomposition products have been studied,no Workplace Exposure Standard is recommended at this stage.

(l) Does not incude the sterates of the toxic metals.

(m) Biological monitoring recommended.

(A1) Confirmed human carcinogen.

(A2) Suspected human carcinogen.

(2001) 2001 change.

(skin) Skin absorption.

(sen) Sensitiser.

(bio) Exposure can also be estimated by biological monitoring.

Appendix 1 Short Term Excursions for Carbon Monoxide Exposure

Exposure to carbon monoxide should be controlled to maintain a carboxyhaemoglobin (COHb) level below **3.5%** (the Biological Exposure Index for CO). Under most conditions this will **be** achieved if the average level over an 8-hour day does not exceed **25** ppm, however there is also a need to control brief periods of high CO exposure. The following guidelines on short-term exposures are recommended:

Short-term Excursions for CO Exposure

Concentration (ppm)	Exposure Period
200 ppm	**15** minutes
100 pprn	30 minutes
50 ppm	60 minutes

- The CO level should not exceed 400 ppm at any time during the day
- The **sum** of the exposure periods during the day at a particular level should not (in total) exceed the period indicated.

MAK- und BAT-Werte-Liste

Die „Senatskommission zur Prüfung gesundheitsschädlicher Arbeitsstoffe" der Deutschen Forschungsgemeinschaft teilt mit, daß die Beratung zu folgenden Stoffen in Kürze abgeschlossen sein wird. Damit ist zu erwarten, daß eine Veröffentlichung der Vorschläge für MAK- und BAT-Werte bzw. Einstufungen als krebserzeugend, fruchtschädigend oder sensibilisierend für diese Stoffe in der MAK- und BAT-Werte Liste am 1. Juli 2001 oder 2002 erfolgen kann. Auf das Mandat und die Arbeitsweise der Kommission, wie sie in den Anhängen zu den Mitteilungen abgedruckt ist, wird hingewiesen.

Stoff	Diskutiert	Anlaß
Acetonitril [75-05-8]	Überprüfung d n MAK-Wertes	Anrcgung aus der Kommission
Aluminium [7429-90-5], seine Oxide [1344-28-1; 1302-74-5] und Hydroxide [21645-51-2; 24623-77-6]	fiberpriifung des MAK-Wertes	Anregung aus der Kommission
Aluminiumoxid-Rauch [1344-28-1]	Oberpriifung des MAK-Wertes	Anregung aus der Kommission
2-Aminoethanol [141-43-5]	Oberpriifung auf sensibilisierende Wirkung	Anregung aus der Kommission
Ammoniumperfluoroctanoat [3825-26-1]	Aufstellung eines MAK-Wertes	Anregung aus der Kommission
Benzo[a]pyren [50-32-8]	Oberpriifung auf keimzellmutagene Wirkung	Anrcgung aus der Kommission
Biphenyl [92-52-4]	Überprüfung des MAK-Wertes	Anrcgung aus der Kommission
Bisphenol-A-diglydidylmethacrylat [1565-94-2]	Überprüfung auf sensibilisierende Wukung	Anregung aus der Kommission
Bitumen [8052-42-4]	Überprüfung der krebserzeugenden Potentials	Anrcgung aus der Kommission
Blei [7439-92-1] und seine Verbindungen	Überprüfung des genotoxischen Potentials Überprüfung des BAT-Wertes für Frauen < 45 Jahre	Anregung aus der Kommission Überprüfung durch die Kommission
1,4-Butandioldimethacrylat [2082-81-71	Oberpriifung auf sensibilisierende Wirkung	Anrcgung aus der Kommisrion
p-tert-Butylcatechol [98-29-3]	fiberpriifung der sensibilisierenden Wirkung	Anregung aus der Kommission
n-Butylmethacrylat [97-88-1]	Oberpriifung auf sensibilisiercnde Wirkung	Anrcgung aus der Kommission
p-tert-Butylphenol [98-54-4]	Oberpriifung auf sensibilisierende Wukung	Anregung aus der Kommission
m-Chloranilin [108-42-9]	Oberpriifung auf sensibilisierende Wirkung	Anregung der BG Chemie
2-Chloropren [126-99-8]	Überprüfung des krebserzeugenden Potentials Überprüfung auf keimzellmutagene Wirkung	Anrcgung aus der Kommission
4-Chlor-o-toluidin [95-69-2]	Überprüfung des krebserzeugenden Potentials	*h g u n g* aus der Komission
Chromoxychlorid [14977-61-8]	Überprüfung auf keimzellmutagene Wirkung	*h g u n g* aus der Kommission
Cobalt [7440-48-4] und seine Verbindungen	Überprüfung des krebserzeugenden Potentials	Anrcgung aus der Kommission
Cyanwassentoff [74-90-8]	Überprüfung des MAK-Wertes	Anrcgung aus der Praxis
Cyclohexan [110-82-7]	Aufstellung eines BAT-Wertes	Anrcgung aus der Kommisrion
1,2-Diaminoethan [107-15-31	Überprüfung des MAK-Wertes	Anregung aus der Kommission

Veroffentlicht: Bundesarbeitsblatt **2001 Nr. 01,** Seite **51**

MAK- und BAT-Werte-Liste

Bek. des BMA vorn 9. Februar 2001 - 111 c 1-35140-

Die „Senatskommission zur Prufung gesundheitsschadlicher Arbeitsstoffe" der Deutschen Forschungsgerneinschaft teilt rnit, daß die Beratung zu folgenden Stoffen in Kürze abgeschlossen sein wird. Damit ist zu erwarten, dass eine Veroffentlichung der Vorschlage für MAK- und BAT-Werte bzw. Einstufungen **als** krebserzeugend, fruchtschadigend oder sensibilisierend fur diese Stoffe in der MAK- und BAT-Werte Liste am 1. Juli 2001 oder 2002 erfolgen kann. Auf das Mandat und die Arbeitsweise der Kornmission, wie sie in den Anhängen zu den Mitteilungen abgedruckt ist, wird hingewiesen.

CAS-Nummer	Stoff	Diskutiert	Anlass
75-05-8	Acetonitril	Uberprijfung des MAK-Wertes	Anregung aus der Komrnission
7429-90-5	Aluminium, seine Oxide	Uberprijfung des MAK-Wertes	Anregung aus der Kornmission
1344-28-1	Aluminiumoxid	Uberprufung des MAK-Wertes	Anregung aus der Komrnission
1302-74-5	Aluminiumoxid	Überprüfung des MAK-Wertes	Anregung aus der Komrnission
21645-51-2	Aluminiumhydroxid	Uberprijfung des MAK-Wertes	Anregung aus der Komrnission
24623-77-6	Alurniniumhydroxid	Uberprufung des MAK-Wertes	Anregung aus der Komrnission
1344-28-1	Aluminiumoxid-Rauch	Uberprijfung des MAK-Wertes	Anregung aus der Kommission
141-43-5	2-Aminoethanol	Uberprufung auf sensibilisierende Wirkung	Anregung aus der Komrnission
3825-26-1	Ammoniumperfluoroctanoat	Aufstellung eines MAK-Wertes	Anregung aus der Kommission
50-32-8	Benzo[a]pyren	Uberprufung auf keimzellmutagene Wirkung	Anregung aus der Kommission
92-52-4	Biphenyl	Uberprijfung des MAK-Wertes	Anregung aus der Kornrnission
1565-94-2	Bisphenol-A-diglydidyl-methacrylat	Uberprufung auf sensibilisierende Wirkung	Anregung aus der Kornrnission
8052-42-4	Bitumen	Uberprufung des krebserzeugenden Potentials	Anregung aus der Kornrnission
7439-92-1	Blei und seine Verbindungen	Uberprijfung des genotoxischen Potentials	Anregung aus der Kornrnission
7439-92-1	Blei und seine Verbindungen	Uberprijfung des BAT-Wertes für Frauen < 45 Jahre	Überprüfung durch die Kommission
2082-81-7	1,4-Butandioldimethacrylat	Überprüfung auf sensibilisierende Wirkung	Anregung aus der Kommission

Stoffen

Overzicht aevaarlijke stoffen; MAC-waarden	Svrnbolen gevaarlijke stoffen	Overzicht R en S-zinnen

De officiele definitie van MAC is:

De rnaxirnale aanvaarde concentratie van een gas, damp, nevel of van een stof, is die concentratie in de lucht op de werkplek die, voor zover de huidige kennis reikt, bij herhaalde blootstelling ook gedurende een langere tot zelfs een arbeidsleven ornvattende periode, in het algemeen de gezondheid van zowel de werknerners alsook hun nageslacht niet benadeelt.

De waarde geldt alleen onder de volgende voorwaarden:
- voor gezonde, volwassen personen;
- voor werkperioden van acht uur, onderbroken door rustperioden in een niet-verontreinigde atmosfeer;
- voor een werkweek van veertig uur;
- bij licharnelijk niet te zware arbeid;
- mits extra bescherrning aanwezig is bij stoffen die gernakkelijk via de huid worden opgenomen;
- mits andere giftige stoffen in de werkruimte afwezig zijn.

De MAC-waardenlijst behoort bij bijlage 3 van de Beleidsregels Arbeidsomstandighedenwetgeving.

Deze bijlage is laatstelijk gewijzigd in:

Stcrt. 064, **1998**
Stcrt. 126, **1998**
Stcrt. **167, 1998**
Stcrt. **036, 1999**

Naam van **de stof**	Cas.nr.	**MAC-**waarde TGG **8** uur mg/m3	C	waarde TGG **15** Mg/m3	H
Aceetaldehyde	**75-07-0**	**180**			
Aceetamide	**60-35-5**	**25**			
Acetofenon	**98-86-2**	**49**			
Aceton	**67-64-1**	**1780**			
Acetonitril	**75-05-8**	**70**			

o-Acetylsalicylzuur	50-78-2	5			
Acrylaldehyde	107-02-8	0,25			
Acrylzuur	79-10-7	5,9			
Adipinezuur	124-04-9	5			
Adiponitril	111-69-3	8,8			

Allylalcohol	107-18-6	5			H
Allylpropyldisulfide	2179-59-1	12			
Aluminium [1]	7429-90-5	10			
Aluminium alkylverbindingen		2			
Aluminium (in water oplosbare zouten)		2			
Aluminiumoxide 111	1344-28-1	10			
Aluminium pyro-poeders		5			
2-Aminoethanol	141-43-5	2,5		7,6	H
Amitrol	61-82-5	0,2			
Ammoniak	7664-41-7	14		36	
Ammoniumchloride (rook)	12125-02-9	10			
Ammonium-oefluoroctanoaat	3825-26-1	0,01			H
Ammoniumsulfamidaat	7773-06-0	10			
p-Anisidine	29191-52-4	0,5			H
Antimoon en -verbindingen (als Sb)	7440-36-0	0,5			
Arsine	7784-42-1	0,2			
Asfaltrook (bitumineus)	8052-42-4	5			
Atrazine	1912-24-9	5			
Azinfos-methyl	86-50-0	0,2			H
Azijnzuur	64-19-7	25			
Azijnzuuranhydride	108-24-7	20	C		
Azodicarbonamide	123-77-3	3			
Barium en oplosbare -verbindingen (als Ba)	7740-39-3	0,5			
Benomyl	17804-35-2	10			
p-Benzeendiamine	106-50-3	0,1			H
Benzeenthiol	108-98-5	12			
Benzeen-1,2,4-tricarbonzuur-1,2-anhydride	552-30-7	-		0,04	
p-Benzochinon	106-51-4	0,4			
Berylliumaluminiumsilicaat	1302-52-9	0,002			
Bifenyl	92-52-4	1			
Bifenyl/fenylether-mengsel		7			
Bis(2,3-epoxypropyl)ether	2238-07-5	0,5			

B

DRAFT

Dupont – Washington Works

Modeled C8 Ground Level Concentrations (Annual Averages)

Model Description	Date	Maximum Impact[1] ($\mu g/m^3$)
DEP - 2000 annual actuals (from original submission)	09/05/01	**2.77 $\mu g/m^3$**
Dupont - 2000 annual actuals[2] (from consent order submission)	04117102	**2.80 $\mu g/m^3$**
DEP - 2000 annual actuals[2] (validation of submission)	04/23/02	**2.67 $\mu g/m^3$**
DEP - facility permitted allowables (pre consent order permitted levels)	04/23/02	**9.47 $\mu g/m^3$**

Note' - All maximum impacts occur at the same fenceline receptor (UTM: 442,135.5 E, 4,346,899 N)

Note[2] – The difference between the modeled results are due to a discrepancy between the way terrain elevations were imported into ISC from USGS DEM's. (highest option vs. interpolated values)

Modeling Procedures and Assumptions:

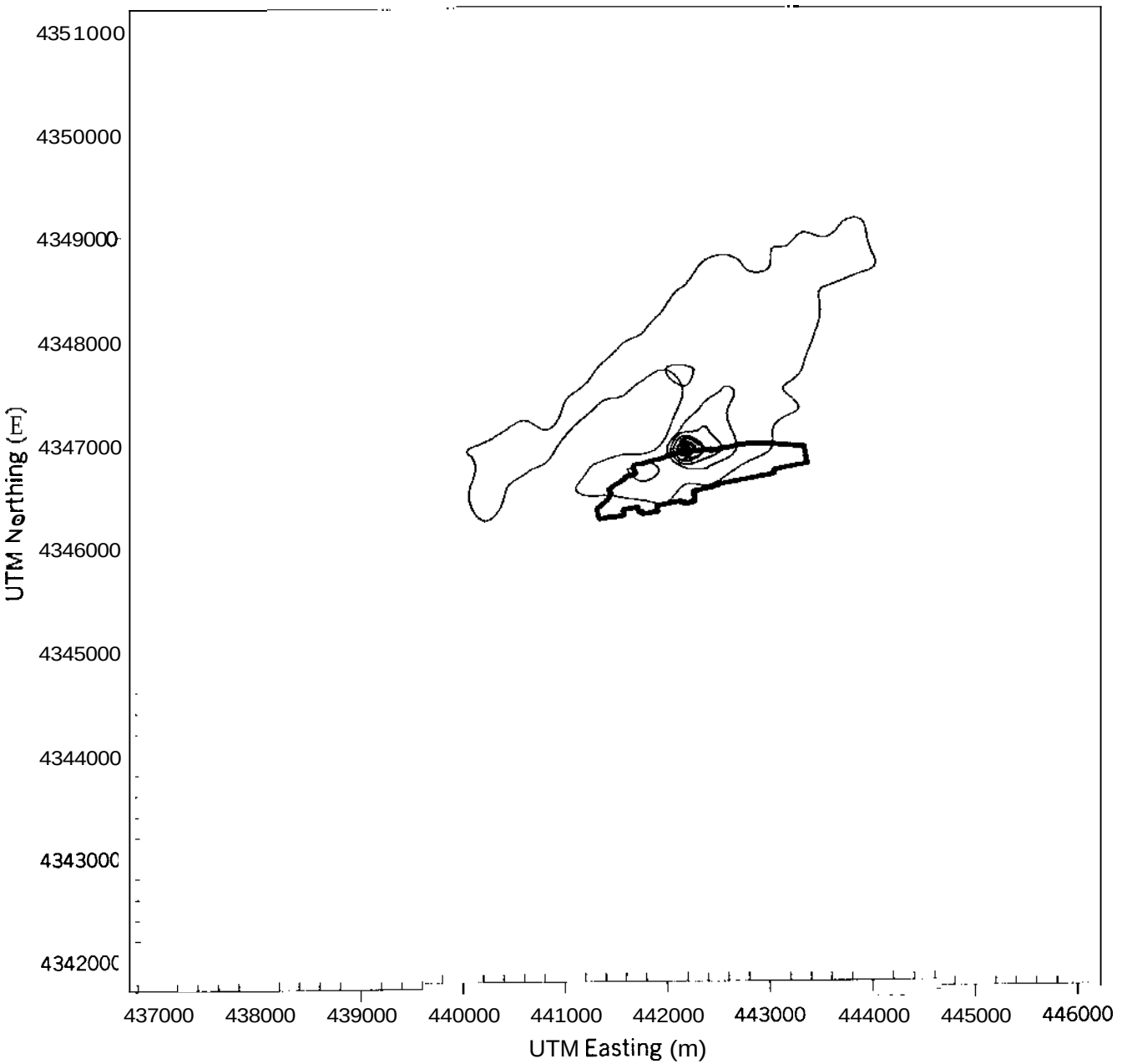
- **ISCST** used in EPA Regulatory Default Mode
- 1 year of onsite meteorology; 1996
- 14 Sources
- Rural Mode
- Simple and Complex Terrain Modes
- Downwash Calculated with **BPIP**
- No Deposition Calculations
- No Half Life
- Concentrations calculated only on an average Annual period

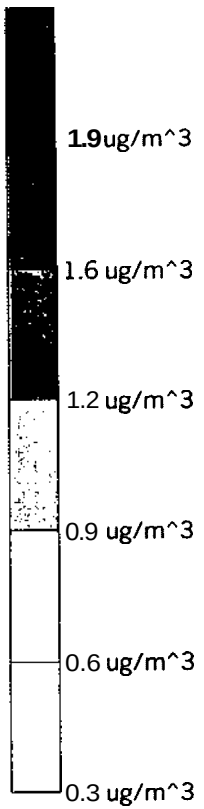
000252

DuPont Washington Works Facility Layout
N

Maximum Modeled C8 Annual Average Concentration Levels
Year 2000 Actual Emissions

Benchmark = none





WVDEP 11674

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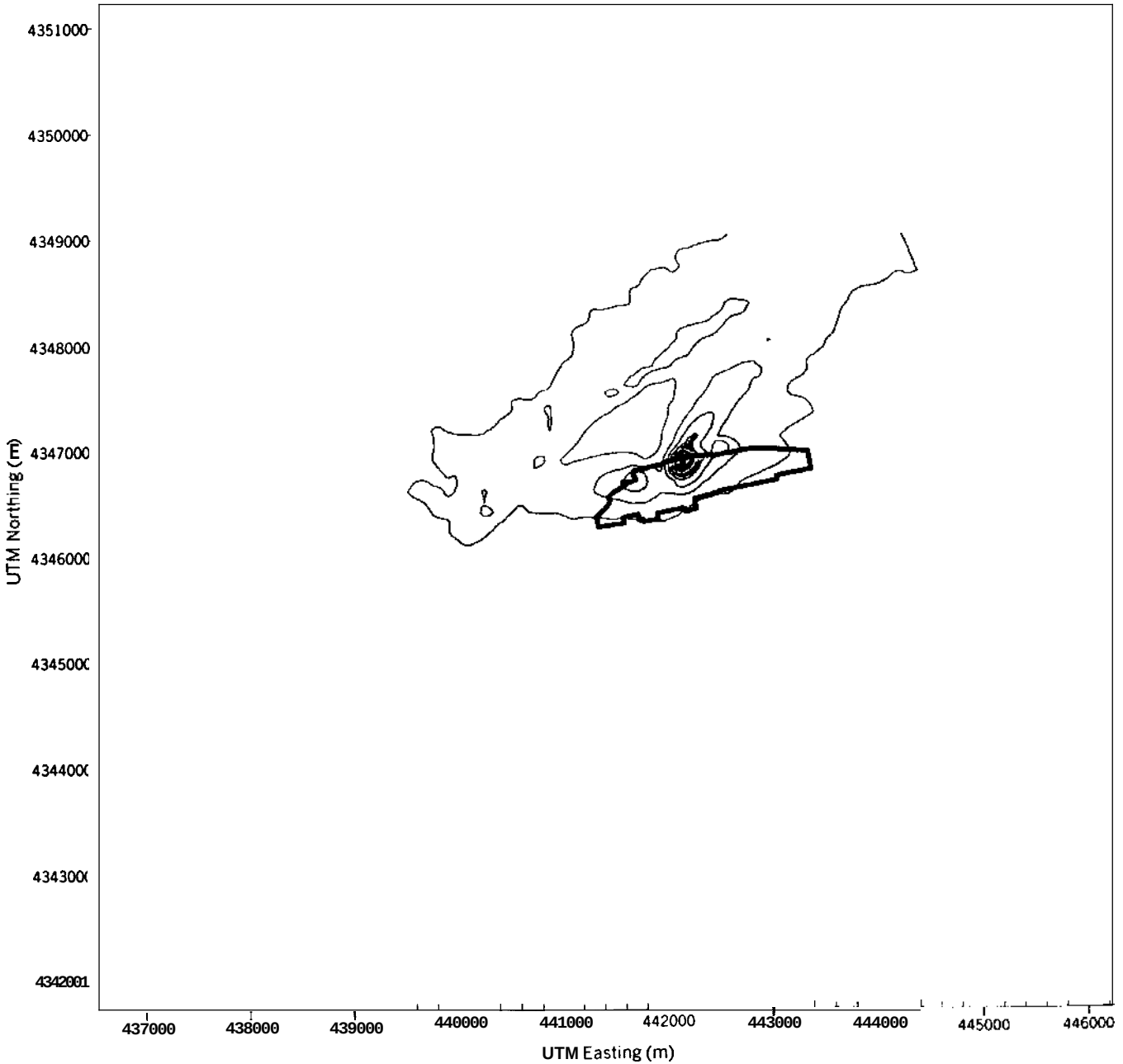
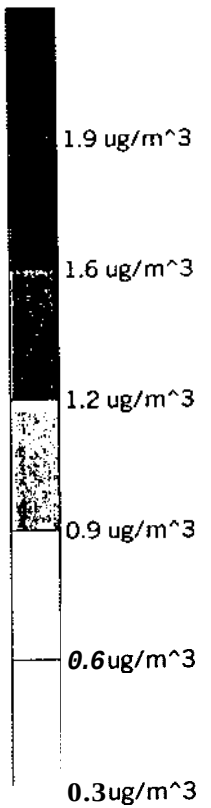
DRAFT - Version 3.0
9/5/2001

Maximum Modeled C8 Annual Average Concentration Levels
Year 2000 Actual Emissions





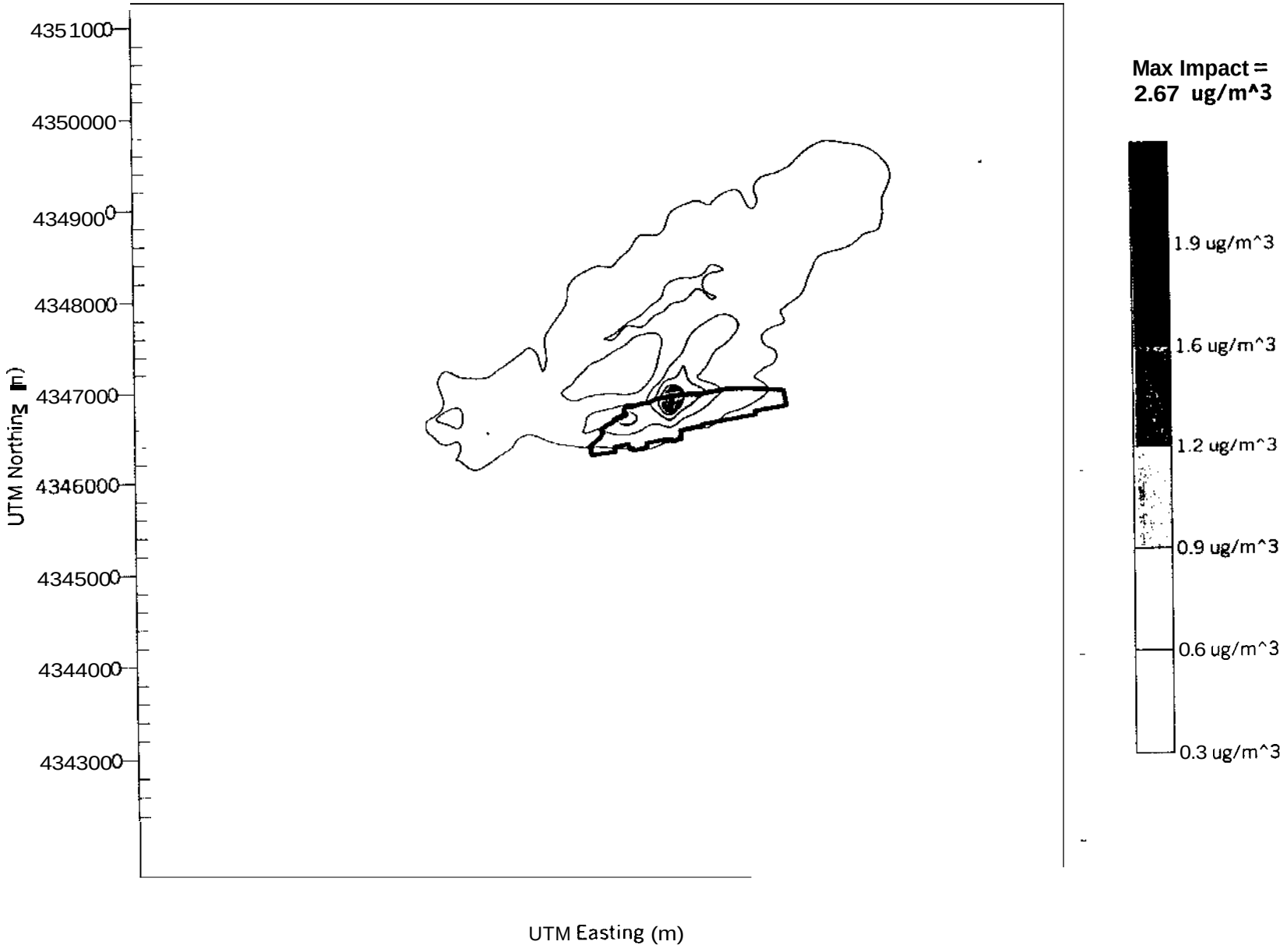
4 DEP 11675

000256

DUPONT RESULTS
4/17/02

Maximum Modeled C8 Annual Average Concentration Levels
Year 2000 Actual Emissions

Benchmark = none



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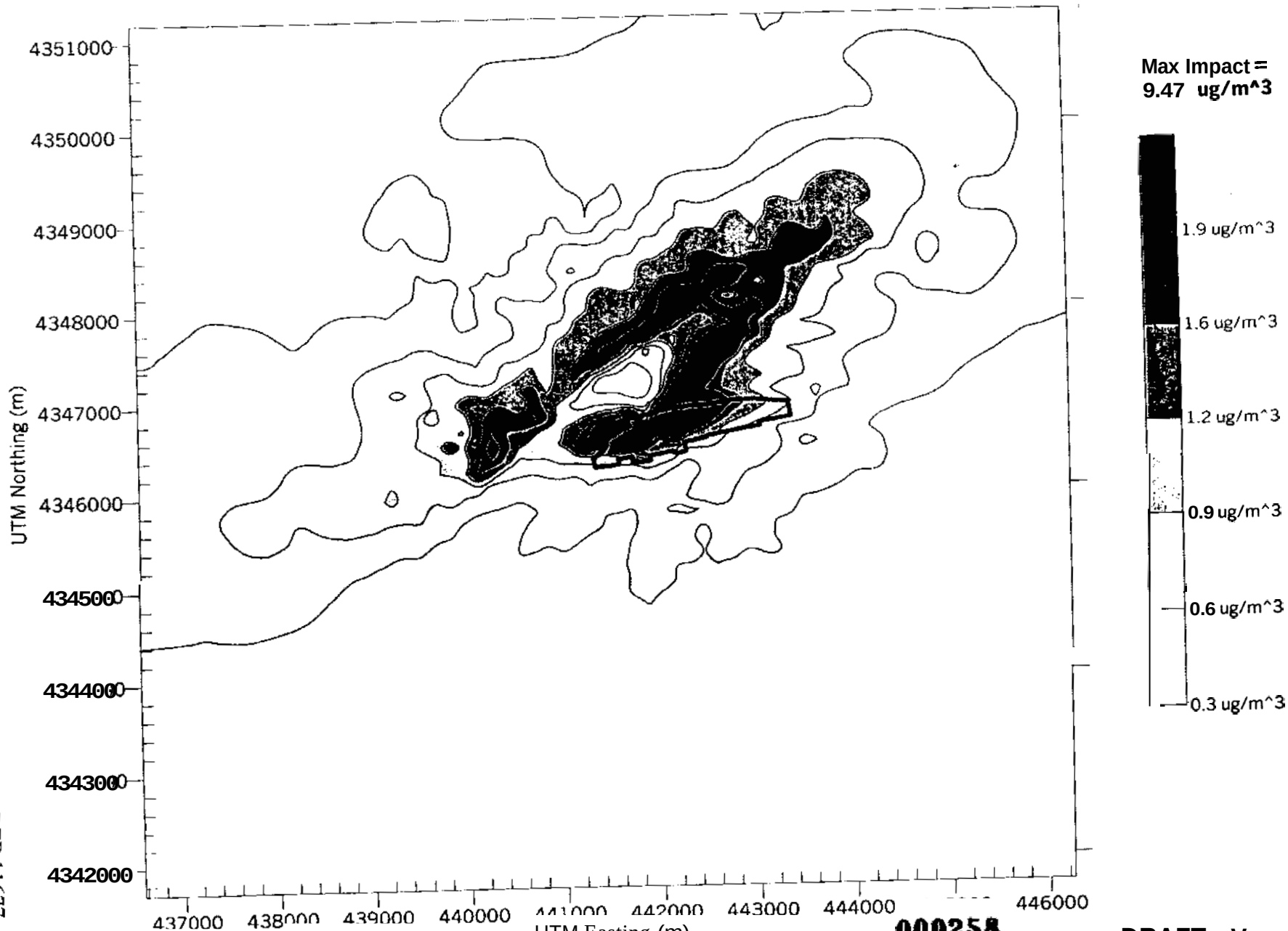
Maximum Modeled C8 Annual Average Concentration Levels
Pre-Consent Order Permit Allowables



WVDEP 11677

000258

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4/23/02

C

October 10,2002

NEWS RELEASE #9

LATEST WELL FIELD SAMPLING RESULTS

Round #6 - Well Field Sampling Results for August 2002
Production Well #1: 3.65 ppb
Production Well #2: 4.26 ppb
Production Well #3: .952 ppb
Production Well #5: 8.09 ppb

Test Well #1: .810 ppb
Test Well #2: .081 ppb
Test Well #3: 4.17 ppb
Test Well #4: 12.3 ppb
Test Well #5: 6.26 ppb
Test Well #6: 1.15 ppb
Test Well #6-2: 1.23 ppb
Test Well #9: .812 ppb
Test Well #10: 1.10 ppb
Test Well #11: 1.73 ppb
Test Well #12: .824 ppb

TEST WELL #4 INVESTIGATION UPDATE

Based on sampling conducted from January to April of this year, Test Well #4 has shown the greatest concentrations of C-8.

In August 2002, at the request of the Ohio Environmental Protection Agency and the Little Hocking Water Association, DuPont began a focused field investigation to delineate concentrations of ammonium perfluorooctanoate, also known as C-8, in soil and groundwater in the Little Hocking Association well field. Details of how the investigation was to be conducted were contained in a Work Plan entitled "Sampling Investigation Plan for Little Hocking Water Association Well Field, Washington County, Ohio". The Little Hocking Water Association, the Ohio Environmental Protection Agency, and DuPont approved this plan before it was implemented.

The field investigation consisted primarily of boring holes in the vicinity of Test Well #4 and obtaining samples of groundwater and soil for analysis. DuPont took some, but not all, of the samples called for in the approved Work Plan. Therefore, **the investigation is currently incomplete until the remaining samples are taken and analyzed.**

It is our understanding from the Ohio Environmental Protection Agency, that the investigation will be completed after review of the sampling results from the initial borings done in August.

During the well field investigation, the Little Hocking Water Association had a representative on-site from Bennett and Williams, an environmental engineering firm from Columbus, Ohio.

000260

The following results are from borings taken as part of the Test Well #4 Investigation conducted in August. These results are from groundwater samples only. The results from the soil samples are not yet available.

Boring S2 (25-30): 78.0 ppb
Boring N1 (17-22): 50.8 ppb
Boring NW 1 (19-25): 34.6 ppb
Boring S 1 (25-30): Non-Detect
Boring NE1 (21-27): 5.58 ppb
Boring NE1 (56-58): .662 ppb
Boring SW1 (28.5-33): .091 ppb
Boring SW1 (40-45): 1.02 ppb
Boring SW1 (35-40): 1.32 ppb
Boring SW1 (45-50): .376 ppb
Boring E1 (21-26): .416 ppb
Boring NE2 (20.7-25.7): 1.28 ppb
Boring W1 (29-34): Non-Detect
Boring NW 1 (24-29)-2: 6.22 ppb
Boring NWI (24-29): 5.90 ppb
Boring W2 (33-38): 3.35 ppb
Boring SW1 (55-56): .254 ppb
Boring SW1 (50-55): .166 ppb

Obviously, we are concerned about the high concentrations of C-8 found in some of these borings, which are higher than what we have seen in the past. However, these concentrations are still below the 150 part per billion level adopted by the State of West Virginia, and currently accepted by the Ohio Environmental Protection Agency. **Our drinking water does not come from these test wells and borings. C-8 levels in our production wells are still far below the 150 ppb level.**

At this point we are awaiting the results of the soil analyses and DuPont's scheduling of the completion of the Sampling Investigation Plan for the Little Hocking Association Well Field.

We remain committed to the pursuit and investigation of this problem, and are dedicated to the protection of our members and the integrity of our water system.

D

CONSENT ORDER ISSUED PURSUANT TO ARTICLES 5 and 12, CHAPTER 22 AND ARTICLE 1, CHAPTER 16 OF THE WEST VIRGINIA CODE.

TO: E. I. DU PONT DE NEMOURS AND *COMPANY* DATE: November 14,2001

West Virginia Department of Environmental Protection **Order No. GWR-2001-019**
West Virginia Department of Health and Human Resources

This CONSENT ORDER is issued by the Director of the Division of Water Resources and Director of the Division *of* Air Quality, West Virginia Department of Environmental Protection, and the Commissioner of the Bureau for Public Health, West Virginia Department of Health and Human Resources, pursuant to the authority set forth in more detail below.

I. INTRODUCTION OF PARTIES.

This Consent Order is entered into by and between the West Virginia Department of Environmental Protection [WVDEP], the West Virginia Department of Health and Human Resources – Bureau for Public Health [WVDHHR-BPH], and E. I. du Pont de Nemours and Company [DuPont][collectively referred to as the "Parties"].

II. PURPOSE OF CONSENT ORDER

This Consent Order sets forth a series of tasks to be performed by the Parties in order to determine whether there has been any impact on human health and the environment as a result of releases *of* ammonium perfluorooctanoate [C8], CAS Number 3825-26-1, to the environment from DuPont operations.. C8 is a material used by DuPont in its fluoroproducts manufacturing process at its Washington Works facility located at Washington, Wood County, West Virginia. C8 is not identified as a hazardous substance, hazardous waste or otherwise specifically regulated under West Virginia or federal statute or regulation.

This Consent Order has been negotiated in good faith and the actions undertaken by DuPont pursuant to this Consent Order do not constitute an admission of any liability on its part. DuPont retains the right to controvert in any other proceedings, other than proceedings to implement or enforce this Consent Order, the validity of the findings of fact and conclusions of law set forth herein. DuPont agrees to comply with and be bound by the terms of this Consent Order and further agrees in any proceeding to implement or enforce this Consent Order that it

will not contest the validity of this Consent Order or the jurisdiction of WVDEP and WVDHHR-BPH to issue it.

III. DEFINITIONS.

Whenever the terms identified below are used in the Consent Order or in any exhibit or attachment hereto, the following definitions shall apply

I. "The Agencies" shall mean the Department of Health and Human Resources, Bureau for Public Health and the Department of Environmental Protection, including the Divisions of Air Quality and Water Resources.

2 "C8" shall mean the chemical compound ammonium perfluorooctanoate.

3. "Detection Limit" means the lowest analytical level that can be reliably achieved within specified limits of precision and accuracy under routine laboratory conditions for a specified matrix. It is based on quantitation, precision and accuracy under normal operation of a laboratory and the practical need in a compliance-monitoring program to have a sufficient number of laboratories available to conduct the analyses.

4. "Effective Date" shall mean the date set forth in Section XVII of this Consent Order.

5. "EPA" shall mean the United States Environmental Protection Agency.

6. "Force Majeure" shall mean conditions or circumstances beyond the reasonable control of DuPont which could not have been overcome by due diligence and shall include, without limitation, acts of God, action or inaction of governmental agencies, or administrative or judicial tribunals or other third parties, or strikes or labor disputes (provided, however, DuPont shall not be required to concede to any labor demands), which prevent or delay DuPont from complying with the work plan.

7. "Groundwater Monitoring Well" shall mean any cased excavation or opening into the ground made by digging, boxing, drilling, driving, jetting, or other methods for the purpose of determining the physical, chemical, biological, or radiological properties of groundwater. The term "monitoring well" includes piezometers and observation wells, which are installed for purposes other than those listed above, but does not include wells whose primary purpose is to provide a supply of potable water.

8. "Groundwater Well" or "Well" shall mean any drilled or excavated groundwater collection system that supplies water for public, private, industrial, or agricultural use and shall include drinking water wells. As used in this Consent Order, this term applies only to wells

located in West Virginia.

9. 'Reimbursable Costs" shall mean costs attributable (on an hourly basis) to the work of Dee *Ann* Staats, Ph.D. in the negotiation and implementation of this Consent Order, the costs attributable to any other participants on the C8 Assessment of Toxicity Team, as described in Attachment C to this Consent Order, who are serving in that position as contractors to WVDEP, *costs* incurred by WVDEP in connection with the public meetings described in Attachment C, and costs attributable to any contractor retained at the direction of the Groundwater Investigation Steering Team (GIST).

10. "Washington Works" shall mean the manufacturing facility owned by DuPont and located in Washington, Wood County, West Virginia, as depicted on Exhibit 1 to this Consent Order.

11. "The Facilities" shall mean the Washington Works and the Local Landfill, depicted on Exhibit 1, the Letart Landfill, depicted on Exhibit 2, and the Dry Run Landfill, depicted on Exhibit 3.

12. "Reference Dose" or "RfD" shall mean an estimate (with uncertainty spanning perhaps an order of magnitude or greater) of a daily exposure level for the human population, including sensitive subpopulations, that is likely to be without an appreciable risk of deleterious effects during a lifetime. Chronic RfDs are specifically developed to be protective for long-term exposure to a compound.

13. "Screening Level" shall mean the concentration in a specific media such as air, water, or soil, that is likely *to* be without an appreciable risk of deleterious effects during a lifetime in the human population.

IV. WAIVER OF RIGHTS.

DuPont waives any and all rights it may have to appeal or challenge the validity or requirements of this Consent Order, and shall not challenge the jurisdiction of the Agencies to issue this Consent Order.

This Consent Order applies to and is binding upon the Parties, and their successors and assigns.

V. FINDINGS OF FACT.

1. C8 is a chemical substance which has no established state or federal effluent or emission standards.

2. C8 is a perfluorinated surfactant manufactured by the 3M Company and others.

Since the early 1950's C8 has been used by DuPont in its fluoropolymer-related manufacturing processes at its Washington Works facility, located in Wood County, West Virginia.

3. Residues containing C8 from fluoropolymer manufacturing processes at Washington Works are or have been released to the air, discharged to the Ohio River, disposed of at the Facilities, and otherwise shipped off-site for destruction and/or disposal. DuPont also captures for recycle a significant portion of used C8.

4. No permits issued to DuPont authorizing releases of pollutants to the environment contain specific limitations on the amount of C8 that may be released to the environment. However, C8 releases are addressed more generally in WVDEP Division of Air Quality permits as particulate matter, PM_{10} (particulate matter with an aerodynamic diameter less than or equal to 10 microns), or as a volatile organic compound.

5. Since as early as 1990, DuPont has performed regular, voluntary water sampling to detect the presence and level of C8 in and around certain of its Facilities in West Virginia and has reported the results of this sampling to various government agencies. Currently, DuPont also samples and reports C8 concentrations in water as required by permits issued by WVDEP and EPA.

6. As a result of DuPont's sampling, C8 has been detected in varying concentrations in and around certain of its Facilities in West Virginia, including private drinking water wells and public water supplies.

7. Analyses of water samples have reported levels of C8 in the Lubeck Public Service District ("LPSD") drinking water supply.

8. DuPont, by and through its use of C8 in the fluoropolymer manufacturing process, is the likely source of C8 presence in and around certain of its Facilities in West Virginia.

9. Along with environmental sampling for C8, DuPont has performed and participated in multiple studies examining the potential effects of C8 exposure on human health and the environment.

10. Studies performed by DuPont and 3M have determined that C8 in sufficient doses, i.e., considering both amount and duration of exposure, is toxic to animals through ingestion, inhalation and dermal contact. Studies have also found that C8 is persistent in humans and the environment.

11. Although DuPont has collected a large amount of data on the presence of C8 in the environment, the Agencies believe that additional information will assist them in delineating the extent and concentrations of C8 in the environment at or near the Facilities. Available data collected by DuPont indicates that C8 is present in the surface and groundwater at the Letart and

Dry Run Landfills and at or near the Washington Works facility.

12. WVDEP and WVDHHR-BPH have determined that it is desirable to ascertain the source of drinking water for persons potentially exposed to C8 in groundwater or surface waters in the area of the Facilities.

13. EPA, WVDEP, and WVDHHR-BPH, in consultation and cooperation with one another, have requested, and DuPont has submitted, information and documents relating to the detection and presence of C8 in and around the Facilities and documents with respect to the human health studies being performed related to C8 exposure.

14. Based upon information submitted by DuPont and reviewed to date by EPA, WVDEP, and WVDHHR-BPH, the Agencies believe that additional data would assist in their evaluation of whether the ground and surface waters now containing C8 have a complete exposure pathway to humans and whether persons in and around the Facilities are at risk of adverse health effects from C8 exposure.

15. There have been no independent governmental or non-industrial studies performed on the human health effects of C8 exposure for the purpose of establishing an exposure standard for C8 applicable to the general public.

16. The Agencies have concluded that full site and health assessments are necessary to ascertain the extent and level of C8 concentrations in the environment and to assist them in determining whether C8 presents any possible danger to the public. DuPont has agreed to participate and assist in this effort.

17. The fluoropolymers industry has committed to EPA to reduce total actual C8 emissions for either the year 1999 or the year 2000 by 50 percent within three to five years of each company's commitment date. DuPont committed to this goal in 2000.

18. DuPont installed, in March 2001, a filter and carbon treatment system at its Washington Works facility that is demonstrating removal efficiency of 90-95% of the C8 in its major C8-containing wastewater stream.

VI. AUTHORITY TO ISSUE CONSENT ORDER

1. The WVDEP is the state agency vested with the authority to protect the environment in West Virginia.

2. Article 12, Chapter 22 of the West Virginia Code, the Groundwater Protection Act, grants to the WVDEP the authority to protect the State's groundwater from any contaminant

and, where contaminated groundwater is found, to institute a civil action or issue an order requiring that groundwater be remediated.

3. Article 5, Chapter 22 of the West Virginia Code, the Air Pollution Control Act, grants to the WVDEP the authority to protect the State's air from pollutants and to institute a civil action or issue orders to enforce the statute.

4. The WVDHHR-BPH is the state agency vested with the authority to regulate and protect drinking water supplies in West Virginia.

5. Article 1, Chapter 16 of the West Virginia Code, *grants* to the WVDHHR-BPH the authority to protect the public drinking water supply of the state and to perform all investigation necessary to assure its purity and safety, and further grants to the WVDHHR-BPH the authority to institute actions and issue orders to restore the purity of said water supply.

VII. REQUIREMENTS OF CONSENT ORDER

The Agencies have concluded that it is of great importance to have sufficient data upon which to determine the scope and potential risk of the presence of C8 in the environment in and around the Facilities. Therefore, the Agencies require the following:

A. Establishment of Groundwater Investigation Steering Team.

1. A "Groundwater Investigation Steering Team" (GIST) shall be established with members of the *team* consisting of WVDEP, WVDHHR-BPH, EPA Region III, and DuPont. The WVDEP representative will be the team leader. The objectives and specific tasks of the team are set forth in full in Attachment A of this Consent Order. However, the primary purpose of the GIST will be to oversee an expeditious, phased approach to fulfilling the majority of the requirements set forth in Sections A through C. The work performed with oversight from the GIST shall be funded by DuPont in accordance with Section VIII of this Consent Order.

2. Upon conclusion of key milestones in the tasks set forth in Attachment A, the GIST shall issue interim or final reports setting forth findings of fact and conclusions regarding background data, groundwater monitoring, and plume identification as described in Attachment A. Any groundwater monitoring plan developed pursuant to Attachment A shall Survive the termination of this Consent Order and shall be incorporated as a minor permit modification for the Facilities. DuPont reserves the right to request modification of the plans upon renewal of the Facilities' permits.

B. National Pollutant Discharge Elimination System Requirements.

1. Except as occasioned by no-flow conditions, DuPont shall perform monthly sampling for C8 at the Local Landfill at certain outfalls identified in West Virginia/National Pollutant Discharge Elimination System ("WV NPDES") Permit No. 0076538 as Outfalls 101, 004 and 005.

2. Except as occasioned by no-flow conditions, DuPont shall perform monthly sampling for C8 at the Washington Works facility at certain outfalls identified in WV NPDES Permit No. WV0001279 as Outfalls 001,002,003,005,007, and 105.

3. Except as occasioned by no-flow conditions, DuPont shall perform monthly sampling for C8 at Dry Run Landfill at all outfalls identified in its WV NPDES Permit No. WV0076244.

4. Except as occasioned by no-flow conditions, DuPont shall perform monthly sampling for C8 at Letart Landfill at all outfalls identified in its WV NPDES Permit No. WV0076066.

5. With respect to the requirements of paragraphs VII.B.1 through VII.B.4, all sampling shall be performed pursuant to established EPA guidelines, where applicable, and results shall be delivered to the WVDEP within thirty days of receiving such results. DuPont shall record and report all attempts to sample under no-flow conditions.

6. Within 90 days of the Effective Date of this Consent Order, DuPont agrees to obtain a sample from each surface or alluvial water intake for public water supplies along the Ohio River in the area extending ten river miles downstream of the Washington Works facility and one river mile upstream of the Washington Works facility. If concentrations of C8 above the Detection Limit are found in any sampled public water supply within the upstream or downstream segments initially sampled, the segments within which intakes are to be sampled shall be extended to twenty river miles downstream or two river miles upstream, as appropriate. If concentrations above the Detection Limit are found in any segment so extended, additional sampling will be performed on water intakes within thirty river miles downstream or three river miles upstream, as appropriate.

7. The additional monitoring requirements contained in this subsection shall be incorporated into the Facilities' West Virginia/National Pollutant Discharge Elimination System permits by minor modification. DuPont reserves the right to request a modification of these requirements upon renewal of the permits.

C. Toxicological and Human Health Assessment.

1. DuPont agrees to fund the various tasks set forth below as a part of this Consent Order by establishing an escrow account at a bank agreed to by the Parties, or by some other

means agreed to by the Parties. Disbursements from said escrow shall be authorized by the C8 Toxicity Team Leader and DuPont representative jointly as described below.

2. A C8 Assessment of Toxicity Team ("CAT Team") shall be established with members of the team consisting of representatives of:

WVDEP
WVDHHR-BPH
EPA Region III
NICS
ATSDR
DuPont

3. The WVDEP representative shall be the Team Leader.

4. The individual team members, the tasks of the team, and the team objectives are set forth in full in Attachment C of this Consent Order.

5. Upon conclusion of all the tasks set forth in Attachment C, the CAT Team shall issue a final report setting forth findings of fact and conclusions as to what extent there may be health risks associated with C8 at the Facilities.

D. Emission Modeling Assessment.

1. The following information shall be submitted to the Division of Air Quality ("DAQ") within 30 days of the Effective Date except where a different deadline is provided in this subsection:

a. A complete and accurate list of building dimension parameters for all structures located within the Washington Works facility that have a significant impact on the dispersion of C8 emissions. Significant impact for each structure on the site shall be determined based on the "area of building wake effects" as defined in the EPA User's Guide to the Building Profile Input Program (EPA-454/R-93-038 Revised Feb. 8,1995).

b. A complete and accurate list of DuPont's current permitted allowable emission rates and confirmed actual C8 emission rates in pounds per year for the year 2000 for all sources located within the Washington Works facility. Each emission point shall be listed according to its stack I.D. and corresponding permit number. For each stack identified above as emitting C8 DuPont shall list all relevant stack parameters to be used in air dispersion modeling.

c. For each emission point (stack) emitting C8, the following information shall be supplied:

i. Phase of C8 (solid, vapor or aqueous solution) at stack conditions.

ii. The particle characterization to be used for modeling including the particle size distribution (microns), the mass fraction of C8 in each particle size category, and the particle density (g/cm^3).

iii. For particulate emissions, scavenging coefficients (hr/s-mm) for both liquid and frozen precipitation to be used for wet deposition modeling based upon the particle size distribution and the EPA's Industrial Source Complex, Version 3 Model Guidance (EPA-454/B-95-003b Sept. 1995) ("ISC Guidance"). DuPont may submit, within 30 days of the Effective Date, information to support the use of the normalized scavenging coefficient in the ISC Guidance (Figure 1 of ISC Guidance) for C8's scavenging coefficients. DAQ shall approve or disapprove with justification in writing, DuPont's submission. Should DAQ disapprove, DuPont shall have the right, within seven days, to request a meeting with DAQ and USEPA to address the deficiencies set forth in DAQ's letter and to request reconsideration of DAQ's decision. Following a meeting of the parties, DAQ shall issue a decision letter regarding C8's scavenging coefficients within seven days of the meeting. DAQ reserves the right to require measurement of C8's scavenging coefficients in its decision and DuPont reserves the right to assert a claim of confidentiality in the event such a measurement is made.

iv. For gaseous emissions, scavenging coefficients (hr/s-mm) for both liquid and frozen precipitation to be used for wet deposition modeling will be provided as a function of droplet size using formulae in the open literature based on the physical properties of C8 and consistent with Section 1.4 of the ISC Guidance. DuPont may submit, within 30 days of the Effective Date, information to support the proposed scavenging coefficient for gaseous emissions including information on the percentage of C8 emissions that would be in gaseous form. DAQ shall approve or disapprove with justification in writing, DuPont's submission. Should DAQ disapprove, DuPont shall have the right, within seven days, to request a meeting with DAQ and USEPA to address the deficiencies set forth in DAQ's letter and to request reconsideration of DAQ's decision. Following a meeting of the parties, DAQ shall issue a decision letter regarding C8's scavenging coefficients Within seven days of the meeting. DAQ reserves the right to require measurement of C8's scavenging coefficients in its decision and DuPont reserves the right to assert a claim of confidentiality in the event such a measurement is made.

d. To the extent that the phases exist, a solid, liquid and vapor phase (T-P) diagram for C8 with respect to pressure and temperature. The temperature and pressure ranges shall be representative of exhaust gas conditions before and *after* control equipment. Estimates of C8's critical properties shall be provided along with measured ranges of phase transition temperatures.

e. In lieu of a binary phase (T-x-y) diagram representing the vapor-liquid equilibrium between water and C8, the solubility and Krafft Point of C8 in aqueous solutions, measured pK value for C8 dissociation in aqueous solutions, and measurements of C8 concentrations or related acids observed when tested in a head space GC at various concentrations, temperatures, and pHs representative of the ranges observed during actual operating conditions. Furthermore a discussion regarding the volatility of C8 in aqueous solutions as a function of pH will be provided. The information in this paragraph shall be submitted to the DAQ within 60 days of the Effective Date.

f. Henry's law coefficient for C8 and a discussion of its dependence on pH. The coefficient shall be defined at various temperatures covering the range observed during actual operations.

g. Any carbon adsorption data in the form of isotherms for C8 adsorption.

DAQ will provide DuPont an opportunity to comment on modeling methodology and assumptions prior to finalizing the modeling results.

2. Any expenses incurred as a result of accurately supplying the information requested above shall be covered by DuPont.

3. Upon submission of the information required by this Subsection VII.D, DAQ reserves the right to disapprove any data if the analytical methodology or quality control procedures are deemed inappropriate.

VIII. REIMBURSEMENT OF COSTS.

1. DuPont agrees to establish an escrow account to fund Reimbursable Costs under this Consent Order. Expenditures from this account shall be made upon joint approval by a duly designated representative of the WVDEP and of DuPont ("designated representatives"). Written notice of such designation shall be sent to the persons identified pursuant to Section XVI of this Consent Order. Prior to the execution of this Consent Order, WVDEP has provided DuPont with an estimate of Reimbursable Costs that WVDEP expects to incur under this Consent Order.

2. Within 10 business days of the Effective Date, DuPont shall deposit in the escrow account funds in the amount of fifty thousand dollars ($50,000). Each expenditure from the escrow account must be supported by an itemized accounting, including invoices and receipts. Said escrow account shall be replenished with additional funds whenever the balance is less than ten thousand dollars ($10,000), or as agreed to by the designated representatives. Any unexpended amount remaining in the escrow account at the conclusion of the work to be performed under this Consent Order shall be returned to DuPont.

3. DuPont's obligation to pay Reimbursable Costs under this Consent Order shall

not exceed two hundred and fifty thousand dollars ($250,000). Except as to Reimbursable Costs which are addressed separately in this section, all other costs incurred by DuPont in carrying out its obligations under Consent Order shall be the sole responsibility and obligation of DuPont.

IX. QUALITY ASSURANCE/QUALITY CONTROL.

All sampling and analyses performed pursuant to this Consent Order shall conform to EPA guidance regarding quality assurance/quality control, data validation, and chain of custody procedures. The laboratory performing the analyses shall be approved by the Parties prior to sampling.

X. C8 REDUCTION PROGRAM.

1. Notwithstanding current permitted emission levels, DuPont agrees to limit overall C8 emissions to the air to no more than actual calendar year 2000 levels on a calendar year basis and shall further provide to the WVDEP monthly emissions reports regarding C8. The reporting requirement contained herein shall be modified to quarterly reports upon the issuance of a Screening Level derived following the procedures set out in Attachment C.

2. DuPont agrees to reduce emissions to the air and discharges to the water of C8 collectively by 50% from actual 1999 levels by December 31, 2003.

3. DuPont shall operate and maintain the filter and carbon bed treatment system at its Washington Works facility with the goal of achieving *90-95%* C8 removal efficiency in its major C8-containing wastewater *stream.*

4. DuPont shall conduct the following construction projects and abide by the specified dates:

a. DuPont shall install an improved scrubber filter to replace recovery device T6IZC on permit R13-815D. Construction shall begin no later than February 28, 2002. Initial operation shall begin no later than the date of start up after the April shutdown, or June 28, 2002, whichever is earlier.

b. DuPont shall modify the stack for emission point T6IZCE so that the emission point elevation is 170 feet above grade. The stack diameter, velocity, and flow rate shall be sized to provide effective dispersion of particulate emissions according to 45 Code of State Rules, Series 20 (Good Engineering Practice as Applicable to Stack Heights). Construction shall begin no later than February 28, 2002. Initial operation shall begin no later than the date of start up after the April shutdown, or June 28, 2002, whichever is earlier. At times when device T6IZC is not operating, permitted emissions from scrubber T6IFC shall be emitted to emission point

T6IZCE.

5. DuPont shall conduct a scrubber optimization and recovery improvement program that shall consist of a study of scrubber operation for device C2DWC2 on permit R13-614A. The study shall be complete by the end of March 2002. Provided the results are encouraging, the company shall implement identified improvements for this device and similar improvements for units C2DTC2 on permit R13-614A, C2EHC2 on permit R13-1953, and C1FSC2 on proposed permit for R13-2365A. Implementation of the improvements for the latter devices will be complete no later than the end of November 2002.

XI. COMPLIANCE WITH SCREENING LEVELS.

1. The following requirements shall apply only if the procedures set out in Attachment C have been followed:

a. No later than 60 days after receipt of notification from the Agencies that data or information developed pursuant to this Consent Order or other information that is recent and valid demonstrates that DuPont's operations have resulted in C8 exposures above the Screening Levels derived following the procedures set out in Attachment C, DuPont shall submit a plan for review and approval by the Agencies that is designed to reduce such exposures to levels below the Screening Levels within a reasonable time (the "Remedial Plan" or "the Plan").

b. Within 30 days of receipt of the Remedial Plan submitted by DuPont, the WVDEP shall, upon consultation with the WVDHHR-BPH and based upon accuracy, quality, and completeness, either approve or disapprove the Plan. If the WVDEP disapproves the Remedial Plan, the WVDEP shall notify DuPont in writing that the Remedial Plan has been disapproved and shall specify the reasons for such disapproval. DuPont shall resubmit the Remedial Plan as revised to address the deficiencies identified in the notice. DuPont's failure to submit an approvable Remedial Plan shall be deemed a violation of this Consent Order.

2. In the event EPA or the WVDEP develops and finalizes a reference dose/screening level for C8 in accordance with applicable statutory and regulatory requirements ("the Regulatory EPA Standard") that would be applicable to Dupont's activities or the Facilities independent of this Consent Order, DuPont's obligations under this Section shall be determined with reference to the Regulatory EPA Standard. DuPont reserves all rights it may have to comment upon, object to, or appeal the Regulatory EPA Standard in proceedings separate and apart from this Consent Order.

XII. COMPLETION OF CONSENT ORDER

1. Except as to DuPont's obligations under Section XI, this Consent Order and DuPont's obligations hereunder shall terminate upon issuance of a completion letter(s) from the Secretary of the WVDEP or his designee and from the Commissioner of the WVDHHR-BPH to

DuPont. In a timely manner following receipt of a written request from DuPont the respective Agencies shall issue the completion letter(s) to DuPont or shall issue a letter to DuPont detailing the obligations and work that have not been completed in accordance with this Consent Order. The Parties agree that the Agencies' obligation to issue this letter shall be deemed a nondiscretionary duty.

2. DuPont's obligation to achieve and maintain compliance with the Screening Levels as provided in Section XI of this Consent Order shall survive the termination of this Consent Order. Such obligation shall terminate only as provided in Section XI or upon agreement of the Parties.

XIII. ADDITIONAL ACTIONS.

The Agencies, individually or collectively, pursuant to their statutory duty and authority, may determine that additional action, beyond the tasks set forth in this Consent Order, is necessary to protect human health and/or the environment. Nothing in this Consent Order shall be construed as restraining or preventing the Agencies from taking such actions. Nothing in this Consent Order constitutes a satisfaction of or release from any claim or cause of action against DuPont for any liability it may have pursuant to the federal Clean Water Act, the federal Clean Air Act, the federal Safe Drinking Water Act, the West Virginia Groundwater Protection Act, the West Virginia Air Pollution Control Act, other statutes applicable to this matter, or West Virginia common law. Nothing in this Consent Order in any way constitutes a modification or waiver of statutory requirements of DuPont and nothing in this Consent Order shall obligate DuPont to undertake any actions not specified herein.

XIV. ENFORCEMENT.

Enforcement of this Consent Order may be had by the filing of a civil action by any of the Agencies in the Circuit Court of Wood County, West Virginia. Violation of the terms and conditions of this Consent Order by DuPont is a violation of the West Virginia Code and may result in enforcement action being taken, including a request for Civil penalties as set forth by law. DuPont shall not be liable for violations of this Consent Order due to any 'Force Majeure" condition.

XV. CONTENTS OF CONSENT ORDER/MODIFICATION.

The entirety of this Consent Order consists of the terms and conditions set forth herein and in any attachments or exhibits referenced herein. Modification of the terms and conditions of this Consent Order including any modification of timeframes or deadlines established in this Consent Order shall be made only by agreement of the Parties in writing, except that modifications to any

requirement set out in the attachments to this Consent Order may be made upon consensus of the members of the GIST or the CAT Team, as appropriate.

XVI. ADDRESSES FOR ALL CORRESPONDENCE

All documents, including reports, approvals, notifications, disapprovals, and other correspondence, to be submitted under this Consent Order shall be sent by certified mail, return receipt requested, hand delivery, overnight mail or by courier service to the following addresses or to such addresses DuPont or WVDEP may designate in writing.

Documents to be submitted to WVDEP should be sent to:

WV Department of Environmental Protection
1356 Hansford Street
Charleston, West Virginia 25301

Attention: Armando Benincasa, Esq.
Attention: Dee Ann Staats, Ph.D.
Phone No.: (304) 558-2508

Documents to be submitted to WVDHHR-BPH should be sent to:

WV Department of Health and Human Resources
Bureau for Public Health
815 Quarrier Street, Suite 418
Charleston, West Virginia 25301

Attention: William Toomey, Manager of Source Water Assessment Program
Phone No.: (304) 558-2981

Documents to be submitted to DuPont should be sent to:

E. I. du Pont de Nemours and Company
Washington Works
P.O. Box 1217
Parkersburg, West Virginia 26102

Attention: Paul Bossert
Phone No.: (304) 863-4305

and

E. I. du Pont de Nemours and Company
Legal Department, Suite D-7
1007 Market Street
Wilmington, Delaware 19898

Attention: Bernard J. Reilly, Esq.
Phone No.: (302) 774-5445

XVII. AUTHORIZED SIGNATORIES/NON-ADMISSION.

The undersigned representatives state that they have had full and fair opportunity to review this Consent Order and have had opportunity to allow for their counsel to do the same, and therefore enter this Consent Order freely and with full knowledge of its terms and conditions.

The undersigned do hereby confirm that they have the authority to enter into this Consent Order and have the authority to bind their respective party.

Neither the terms of this Consent Order, nor execution thereof shall constitute an admission by DuPont of any fact or of any legal liability. DuPont expressly reserves all rights arid defenses that may be available in any proceeding involving third parties or involving WVDEP and WVDHHR-BPH in any other matter.

This Consent Order may be signed in counterparts and shall be effective upon signature of all the Parties below ("Effective Date").

Entered this 14th day of November 2001, by:

WEST VIRGINIA DEPARTMENT OF ENVIRONMENTAL PROTECTION

BY

William E. Adams

WILLIAM E. ADAMS, DEPUTY SECRETARY
West Virginia Department of Environmental Protection
1356 Hansford Street
Charleston, West Virginia 25301

Entered this 15th day of November, 2001, by:

WEST VIRGINIA DIVISION OF HEALTH AND HUMAN RESOURCES -- BUREAU FOR PUBLIC HEALTH

BY:

DR. HENRY TAYLOR, COMMISSIONER
Bureau for Public Health
West Virginia Department of Health and Human Resources
Diamond Building, Room 702
350 Capitol Street
Charleston, West Virginia 25301

Entered this 15th day of Nov, 2001, by:

E. I. DU PONT DE NEMOURS AND COMPANY

BY:

PAUL BOSSERT, PLANT MANAGER

Attachment A

C8 GROUNDWATER INVESTIGATION STEERING TEAM

A team of scientists shall be assembled to assess the presence and extent of C8 in drinking water, groundwater and surface water at and around the DuPont Washington Works facility, and the Local, Letart, and Dry Run Landfills. The Groundwater Investigation Steering Team (GIST) shall include scientists &om WVDEP, WVDHHR-BPH, EPA Region III, and DuPont. DuPont shall fund the GIST via an escrow account as provided in Section VIII of the attached Consent Order ("the Consent Order"). Disbursements from this account shall be authorized jointly by the WVDEP GIST leader, and the DuPont representative, Andrew S. Hartten.

A schedule summarizing key GIST tasks, submittals, start and end dates is provided at the end of this document.

GIST Member Organizations/Representatives/General Functions

WVDEP

David Watkins -Groundwater Protection- GIST team leader, escrow funds disbursement oversight; project management and coordination
George Dasher-advisor and technical review
Dee Ann Staats, Ph.D.-advisor

EPA Region III

Garth Connor-science advisor
Jack C. Hwang – Hydrogeologist
Roger Rheinhart-Environmental Engineer

DuPont

Andrew Hartten-Principal Project Leader/Hydrogeologist-technical review, project management and coordination of field investigation activities; escrow funds disbursement oversight.

WVDHHR-BPH

William Toomey-Manager, Source Water Assessment Program- Bureau for Public Health advisor

GIST Team Objectives and Efforts

The primary objective of the GIST is to efficientlyreview and direct groundwater and surface water monitoring and investigation activities as prescribed in the Consent Order and in this Attachment. The GIST will utilize a phased approach and employ rapid team decision making toward meeting the requirements in an efficient and timely manner. Unless otherwise directed by the GIST, the tasks outlined below shall be performed by DuPont or its representatives.

The GIST will issue a final report(s) with findings and conclusions regarding groundwater quality in and around the Facilities, and the extent of groundwater contamination in and around the Facilities. The GIST final report shall further make recommendations regarding the need for any further work or actions that need to be taken to assure protection of groundwater quality and human health into the future.

The tasks set forth below and in the Consent Order are the minimum tasks to be performed by DuPont and the GIST pursuant to the Consent Order. Additional tasks may be necessary to assure the goals [full groundwater assessment and C8 impact, plume identification, and receptor identification] of the GIST and the Consent Order are met. Those tasks shall be agreed upon by the GIST.

Key Tasks of GIST

Task A: Groundwater Use and Well Survey/Groundwater Monitoring

- Objectives: Conduct a distance-phased groundwater well and water use survey within a 1-mile (and possibly 2 and 3-mile) radial distance or directionally focused distance of the Washington Works and Local, Letart, and Dry Run Landfills.[1]
- Summary: The phased approach to the water and groundwater well use survey will allow the GIST to focus efforts along established C8 impact transport pathways and cease activities in directions where impacts are not present or where there are minimal concentrations. Data results tables will be generated in a timely manner to allow the GIST to meet, evaluate the data, and determine the next course of action. The GIST will determine when the final groundwater well use survey shall be released.

  DuPont agrees to perform, under the supervision of the GIST and through an agreed-to third party, a groundwater use and well survey identifying and sampling all groundwater wells within a 1-mile radius of the three landfills set forth above and the Washington Works facility. The phased approach may be amended by the GIST should field conditions require, e.g., lack of sampling wells in the I-mile radius, lack of quality sampling points within the 1-mile radius.

  Sampling shall be performed with the specific purpose of finding and measuring the C8 concentration in water. Should concentrations of C8 found in groundwater wells exceed 1 µg/l within the 1-mile radius, the GIST will determine

1 The water use survey should be in substantially the same format as Attachment B.

whether to expand the well survey to a 2-mile radius, a 3-mile radius, or in a specific direction only. Drinking water wells that measure above 1 µg/l shall be re-sampled at a frequency to be determined by the GIST.

Note: The level of 1 ug/l is utilized in this Consent Order for monitoring purposes only and not as a benchmark for determining risk and this level may be adjusted as determined the GIST in furtherance of the tasks and objectives set forth in this Attachment.

- Timing: The initial well survey within a 1-mile radius of the Facilities will be conducted within 60 days of the Consent Order's Effective Date. Additional well survey activities will be conducted on a schedule to be determined by the GIST.

Task B: Assessment of Existing Groundwater and Surface Water Monitoring Data

- Objectives: Develop and implement a monitoring plan that determines the presence and extent of C8 in drinking water, groundwater, and surface water in and around the Washington Works facility and Local, Letart, and Dry Run Landfills and provide a compilation of all available groundwater/surface water monitoring and hydrogeologic characterization data for each facility, as reflected in Table A-1.
- Summary: The GIST will be tasked with an expedited evaluation of existing historical data and hydrogeologic information in order to prioritize the initial scope of work for continuing groundwater monitoring and any additional investigation activities (e.g., monitoring well installations) required under plume identification. DuPont shall provide all historical data and hydrogeologic information it may have related to the Facilities.
- Timing: Within 30 days of the completion of Task A, the GIST will review all the C8 analytical and facility hydrogeologic information to determine the scope of work for groundwater monitoring and additional investigation. The GIST will then establish a schedule for those activities. It is anticipated that a summary of all historical information for each facility will be submitted to GIST within 60 days of the Consent Order's effective date.

Task C: Plume Identification/Groundwater Assessment

- Objective: Determine the vertical and horizontal extent of any and all C8 impacted groundwater exceeding 1 ug/l or as directed by the GIST, which may determine a lower threshold than 1 ug/l. This task shall also include an assessment of C8 impacted groundwater at Letart Landfill and its impact on the Ohio River and public water supplies along the river.
- Summary: The GIST shall first review historical data and results of Task A to determine an appropriate scope of work. Activities should be prioritized to address groundwater plumes contributing to or with the potential to flow toward off-site receptors, with emphasis on those areas where groundwater is used as a drinking water source.

Upon completion of investigation activities, DuPont shall provide the GIST with predicted groundwater flow and contaminant transport models to assess future plume migration.

Timing: Upon review of all available information and on a schedule to be determined by the GIST, the GIST will complete an initial evaluation of data to determine and prioritize plume identification.

The timing of the initial phase of plume identification/investigation activities and other activities will be on a schedule established by the GIST. Further investigatory activities needed and agreed to by the GIST to carry out the goals of the GIST shall be performed by DuPont on a schedule established by the GIST.

Modeling

Any and all modeling performed pursuant to this attachment and the Consent Order shall use Groundwater Modeling System, or some other model as approved by the GIST.

TABLE A-I

COMPLETE REPORTING REQUIRED TO ADMINISTRATIVE ORDER	
a. Dependent upon the availability of certain information, an historical data summary documented in a report that includes:	• A location map. • A site map showing the location of all known groundwater monitoring wells, residential groundwater wells and public water supply within a 1-mile radius the Facilities. • Top-of-groundwater maps. These should span the entire sampling life of the site and should be no less than yearly. If DuPont has only one year's worth of data for a given site, then these maps should be for each quarter; if DuPont has several years worth of data for each site, then these maps can be annual. • C8 concentration contour maps. These should span the entire sampling life of the site and should be no less than yearly. If DuPont has only one year's worth of data for a given site, then these maps should be for each quarter; if DuPont has several years worth of data for each site, then these maps can be annual. • All the C8 groundwater data that has been collected to date. These data should be submitted in easy-to-read tables. These tables should use the method, "<x", to designate all concentrations below the laboratory's minimum detection limit (not "ND" or some other abbreviation), and they should use "mg/" or "µg/" as the unit designation. • If unable to provide the above data, DuPont shall document the reasons why it is unable to gather and submit the information.
b. A groundwater monitoring plan for the Facilities which should address, at a minimum:	• C8 sampling. The samples should be taken from all the wells at the three landfill sites and from a select number of wells at the Washington Works plant. These select wells are to be chosen by the GIST before the groundwater monitoring program begins based on evaluation of historical data/information. The frequency of sampling shall be monthly for the first four months following the Effective Date and quarterly thereafter. Any new wells required for monitoring or plume identification purposes will be integrated in each site's groundwater monitoring program on a schedule agreed to by the GIST.

	• Report of Results. Reporting should be quarterly and to the WVDEP Groundwater Program at the following address. WVDEP Division of Water Resources Groundwater Program 1201 Greenbrier Street Charleston, West Virginia 25311 Re: DuPont/C8 monitoring. • Each report should include the following: (a) A site location map. (b) A site map showing the groundwater monitoring well locations. (c) A top-of-groundwater map. (d) A C8 concentration map. (e) Groundwater elevation and well screen data. (f) A table of all the historical C8 sampling data. Note: where available information allows, abbreviations should not be used to designate No Detect concentrations and the units "ppb" and "ppm" should not be used. (g) Laboratory analysis sheets. (h) Chain of custody records.

Attachment B

GROUNDWATER WELL USE SURVEY

Name: _____

Address: _____
_____
_____

Phone: _____

Best Time to Contact Owner: _____

1. Do you have one or more water well(s) on this property? (It need not be in use currently.) If no, stop now and return survey. Yes _____ No _____

   County Water Well Permit No. _____

2. Is the well(s) currently (circle one) used unused or filled in?

3. Is the well(s) used for drinking water? Yes _____ No _____

4. Is this well(s) used for other purposes? If yes, please specify uses below:

_____
_____
_____
_____

5. What is the approximate frequency of use? Circle One:

   Daily Weekly Monthly Summer

6. Date last used? _____

7. Is there a pump in the well? Yes _____ No _____

8. Is there a conditioner, softener, chlorinator, filter, or other form of treatment for the system? Yes _____ No _____

If so, what is the form of treatment? _____

9. Is there any faucet where water does not first pass through the treatment system?
Yes _____ No _____

If yes, is it (circle one) inside or outside?

10. What year was the well constructed? _____

11. Please provide the following information regarding the well(s) if known: (circle one)

A. Total Depth (feet below ground surface):

3040 60-90 90-120 120 or more

B. Casing Type:

PVC steel stone none other _____

C. Well Construction:

dug drilled open or uncased bedrock

D. Screened Interval (length in feet):

0-10 10-20 20-30 30-60 60 or more

E. Well Diameter (inches):

0-6 6-12 12-24 24 or more

Attachment C

C8 ASSESSMENT OF TOXICITY TEAM

A team of scientists shall be assembled to assess the toxicity and risk to human health and the environment associated with exposure to ammonium perfluorooctanoate (C8) releases from DuPont's activities. The C8 Assessment of Toxicity Team (CAT Team) shall include scientists from academia, government, non-profit organizations, and industry. The CAT Team also shall include the WVDEP Environmental Advocate, Pam Nixon, as a representative of West Virginia's citizens.

The WVDEP, utilizing funds from an escrow account funded by DuPont, shall contract with a non-profit organization, the National Institute for Chemical Studies (NICS), for the services described herein. Point of contact for the NICS shall be Jan Taylor, Ph.D. The NICS shall subcontract with Marshall University's Center for Rural and Environmental Health for services in risk communication provided by James Becker, M.D. and his staff. Dr. Becker shall familiarize himself with the toxicity of C8, the work performed by TERA as described herein, and attend public meetings to provide expertise in risk communication. The NICS shall subcontract With the non-profit scientific organization, Toxicology Excellence for Risk Assessment (TERA) whose point of contact is Joan Dollarhide, Ph.D. The TERA shall provide Services in toxicology and risk assessment. Work assignments, tasks, and deliverables are described below.

CAT Team Member Organizations/ Representatives'/ General Functions

WVDEP

Dee Ann Staats, Ph.D. - Science Advisor - team leader, escrow funds disbursement oversight; project management and coordination; toxicology/risk assessment and communication;

Pam Nixon - Environmental Advocate - advisor,

NICS

Jan Taylor, Ph.D. –contractor administrative oversight;

James Becker, M.D. (Marshall University) - consultant in risk communication;

TERA (point of contact: Joan Dollarhide, Ph.D.)- consultant in toxicology/risk assessment;

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[1] The parties may, in their discretion, elect to substitute their representatives with persons of similar qualifications.

DuPont

Gerald Kennedy, Director of Applied Toxicology and Health, Haskell Laboratory - reviewer toxicology; escrow funds disbursement oversight;

John Whysner, M.D.– toxicology/risk assessment and communications;

Paul Bossert – Washington Works Plant Manager – communications;

The following members of the CAT Team shall act as reviewers or advisors.

W Department of Health and Human Resources –Bureau for Public Health (WVDHHR-BPH)

William Toomey – Manager, Source Water Assessment Program - advisor,
Barbara Taylor – Director, Office of Environmental Health Services - advisor,
Local representative - advisor,

Environmental **Protection Agency (EPA)**

Headquarters - Jennifer Seed – reviewer and advisor toxicology;
Region III Philadelphia -
Samuel Rotenberg, Ph.D. – reviewer and advisor toxicology/ risk assessment;
Garth Connor – advisor hydrogeology;
Roger Reinhart – reviewer and advisor Safe Drinking Water Act;
Cincimati - John Cicmanec, DVM – reviewer and advisor toxicology;

Agency for Toxic Substances and Disease Registry (ATSDR)
Atlanta - John Wheeler, Ph.D. - reviewer and advisor in toxicology/ risk assessment;
Philadelphia - Lora Werner - coordinator for ATSDR;

Non-CAT Team Efforts

Other efforts are currently underway which may produce information for the CAT Team to utilize. The CAT Team will coordinate and communicate closely with these other efforts. These include:

1. Dupont's air modeling of C8 emissions from the Washington Works plant;

2. WVDEP's air modeling of C8 emissions from the Washington Works plant;

3. USEPA Draft Hazard Assessment which summarizes the available toxicity information regarding C8, to the extent completed prior to the assessment contemplated herein;

4. ATSDR's Health Consultation that estimates the risk to the community associated with C8 in drinking water from the Lubeck Public Service District, to the extent completed prior to the assessment contemplated herein.

5. Existing C8 concentrations in Lubeck Public Service District data.

6. Groundwater C8 Analysis (see GIST activities described in Attachment A) and Well Use Survey (see example survey in Attachment B) at the residences in the area of the 3 landfills and the Washington Works Plant.

Tasks of CAT Team

The tasks to be performed by the CAT Team are described briefly in Table 1, and in more detail below. These tasks are discussed below within the context of a Scope of Work for both Dr. Becker and for TERA as well.

Tasks of the CAT Team shall be organized into three phases. Phase I includes those tasks necessary to prepare for and hold the first public meeting. In Phase II, TERA shall conduct such scientific tasks as: reviewing available toxicity and epidemiological studies; developing Provisional Reference Doses and Screening Levels for protection of human health; evaluating existing information relative to ecological health; and conducting one general risk assessment involving comparisons of exposure concentrations to Screening Levels, for the three landfills and the Washington Works Plant, and the Lubeck Public Service District. TERA shall prepare a report on their findings. Phase III includes those tasks necessary to prepare for and hold the second public meeting. The results of the C8 groundwater analysis and risk assessment shall be presented in the second public meeting.

No communication between Dupont representatives and NICS, Dr. Becker, or TERA shall be permitted without the participation of Dr. Staats. All information will be provided to Dr. Becker and TERA by WVDEP; thus, all information contributed to the effort by Dupont shall be sent in triplicate to Dr. Staats for forwarding to Dr. Becker and TERA.

Phase I TASK A-1: First Public Meeting

Two public meetings are anticipated for this project. The First Public Meeting shall occur in Phase I for the purposes of introducing the CAT Team and other involved parties to the public; relating historical information on previous concentrations of C8 in Lubeck Public Service District water supply; informing the citizens of the ensuing activities; and inviting the public to participate by cooperating with sampling and survey efforts in the Groundwater C8 Analysis and Well Use Survey. In order to prepare for the

First Public Meeting, CAT Team members shall familiarize themselves with the available toxicological information concerning C8.

A CAT Team meeting shall be held immediately prior to the first public meeting to: (1) conduct a site visit to the three landfills and the Washington Works Plant, and surrounding residential areas; (2) discuss the toxicity of C8 and other pertinent data; (3) prepare an agenda for the public meeting; (4) coordinate and prepare for the public meeting. Finally, the First Public Meeting will be held and public questions and comments will be recorded by WVDEP.

TABLE 1. TASKS OF CAT TEAM

Task A: Public Meetings (two meetings are anticipated) Objective: to inform the local citizens of the following: (in Meeting #1) intent to perform a groundwater well use survey and analysis for C8; intent to develop Screening Levels; and to ask for their cooperation in conducting the water use survey; and (in Meeting #2) results of survey, chemical analysis, and risk assessment. Note that an interim public meeting may be required should six months pass from the first public meeting and the CAT Team Final Report has not been issued. Primary Responsibility: Staats
Task B: Development of Provisional Reference Doses Objective: to develop Provisional References Doses for C8 for the inhalation and ingestion (and dermal, if possible) routes of exposure. Primary Responsibility: TERA
Task C: Development of Screening Levels Based on Protection of Human Health Objective: to utilize the Provisional Reference Doses to develop human health risk-based Screening Levels for C8 in air, water, and soil. Note a determination of the potential carcinogenicity of C8 will be conducted as well. Primary Responsibility: TERA
Task D: Ecological Data Review Objective: to review available information to determine whether sufficient studies have been performed and data have been collected to develop screening criteria for ecological receptors. Primary Responsibility: TERA
Task E: Draft Report and Final Report Objective: to present and discuss the results of the above tasks. Primary Responsibility: TERA

Phase II Tasks B, C, D, and E Development of Provisional Reference Doses and Screening Levels, and Risk Assessment

In Phase II, TERA shall conduct the toxicological and risk assessment activities. After having reviewed the toxicological information regarding C8 provided by WVDEP, TERA shall consult with toxicologists on the CAT Team, as coordinated by Dr. Staats, regarding its proposed approach for this project. Following such consultation, TERA

shall develop Provisional Reference Doses for C8 for the oral, inhalation, and dermal (if possible) routes of exposure. Then TERA shall calculate Screening Levels for water, soil and air based on the risk factors they have estimated. TERA shall perform one general risk assessment involving comparison of exposure concentrations to Screening Levels for the three landfills and the Washington Works Plant, and the Lubeck Public Service District water supply, that focuses on current risk to human health, including workers and residents. This risk assessment shall include: (1) identification of reasonably anticipated land use, surface water and groundwater use; (2) identification of receptors; (3) identification of exposure pathways; (4) identification of exposure concentrations; and (5) comparison of exposure concentrations to appropriate Screening Levels. TERA shall utilize data obtained from the other efforts discussed above such as air modeling; groundwater C8 concentrations in residential and public wells; residential groundwater well use survey; the USEPA's Draft Hazard Assessment; and ATSDR's Health Consultation (if available). TERA also shall review available information to determine whether sufficient studies have been performed and data have been collected to develop screening criteria for protection of ecological health, particularly aquatic life. TERA shall prepare a draft and a final document that discusses the results of their efforts and summarizes the data utilized from other efforts. As the tasks of the CAT Team and other involved parties' progress, data gaps and research recommendations may become evident. These shall be included in TERA's report as suggestions for further research to elucidate the toxicity of C8.

Phase III Second Public Meeting

The purpose of the Second Public Meeting is to present to the citizenry the results of the efforts of the GLST and CAT Teams including C8 concentrations in groundwater from residential wells and public wells the screening levels and the general risk assessment. Air modeling results of the efforts of WVDEP and Dupont will be discussed also. The WVDEP will address any further actions that may be necessary.

SCOPE OF WORK FOR JAMES BECKER, M.D.

Dr. Becker is a medical doctor specializing in environmental health at the Marshall University School of Medicine Center for Rural and Environmental Health. He will be assisting the WVDEP in his specialty area of risk communication at the two anticipated public meetings. The specific tasks assigned to Dr. Becker are described below.

Phase I Task A-1 : First Public Meeting

Dr Becker will assist in preparation for the first public meeting, and attend the meeting providing expertise in risk communication. He will familiarize himself with the available toxicological data, which will be provided to him by WVDEP, with particular emphasis on the epidemiological studies. Note that the toxicological data already has been summarized in the Draft Hazard Assessment prepared by USEPA. No literature search or document retrieval will be required Specific subtasks required in Phase I to prepare for the first public meeting are described below:

Subtask 1 – Familiarization with toxicological data provided by WVDEP including but not limited to:

a. 8 compact discs of information provided to USEPA under TSCA by 3M Corp (note only a small portion of this information concerns C8);
b. Draft Hazard Assessment document from USEPA,
c. ACGIH Threshold Limit Value (TLV).
d. Journal articles and other information provided by WVDEP.

Subtask 2 – Attend a meeting prior to the first public meeting to:

a. conduct a site visit of the 3 landfills and the Washington Works Plant, and local residential areas;
b. discuss and prepare an agenda;
c. discuss the toxicology and risks associated with C8 With the other CAT Team members.

Subtask 3 – Attend First Public Meeting

Phase III Task A-2 Second Public Meeting

Dr Becker will assist in preparation for the second public meeting, and attend the meeting providing expertise in risk communication. The following subtasks will be required:

Subtask 1 – Familiarization with the toxicological and risk assessment report prepared by TERA;

Subtask 2 – Attend a meeting prior to the second public meeting to:

a. discuss the toxicology and risks associated with C8 with the other CAT Team members;
b. discuss and prepare an agenda.

Subtask 3 – Attend Second Public Meeting

Note that the second public meeting is assumed to be the final public meeting; however, results of data collection may warrant additional public meetings and an expansion of the Scope of Work.

SCOPE OF WORK FOR TERA

TERA (Toxicology Excellence for Risk Assessment) is a non-profit organization that applies sound toxicological data to the risk assessment process to find common ground between environmental, industry, and government groups. TERA will be providing services in toxicology and risk assessment. TERA scientists will be developing risk factors and screening criteria; and conducting one general risk assessment for the 3 landfills, Lubeck Public Service District water supply and the Washington Works Plant. The specific tasks assigned to TERA are described below.

Phase II Tasks B, C, D, and E: Development of Provisional Reference Doses and Screening Levels, and General Assessment **of Risk**

Subtask 1 – TERA staff will familiarize themselves with the toxicological data provided to by WVDEP. No literature search or document retrieval will be required. Toxicological data to be provided to TERA shall include but is not limited to the following:

a 8 compact discs of information provided to USEPA under TSCA by 3M Corp (note only a small portion of this information concerns C8);
b. USEPA Draft Hazard Assessment for C8;
c Journal articles and other information submitted to WVDEP by DuPont.

Subtask 2 – TERA staff will:

a identify all possible critical toxicological studies suitable for developing Reference Doses for the oral, inhalation, and dermal (if possible) routes of exposure;
b. outline methodology for developing said Reference Doses and for developing Screening Levels for air, water, and soil based on said Reference Doses corresponding to each critical study identified in subtask 2-a;
c. convene a meeting at the TERA facility in Cincinnati, Ohio, to present their findings in subtask 2-a and 2-b, and consult with CAT Team toxicologists as coordinated by Dr. Staats;
d. finalize Reference Doses and Screening Levels based on recommendations of the CAT Team toxicologists as coordinated by Dr. staats.

Subtask 3 – TERA shall conduct one general risk assessment for the three landfills and Washington Works Plant, and the Lubeck Public Service District water supply based on current risk to human health. This risk assessment shall include:

a) identification of reasonably anticipated land use, surface water and groundwater uses;

b) identification of receptors;
c) identification of exposure pathways;
d) identification of exposure concentrations;
e) comparison of exposure concentrations to appropriate Screening Levels;

TERA shall utilize the following data in the risk assessment process:

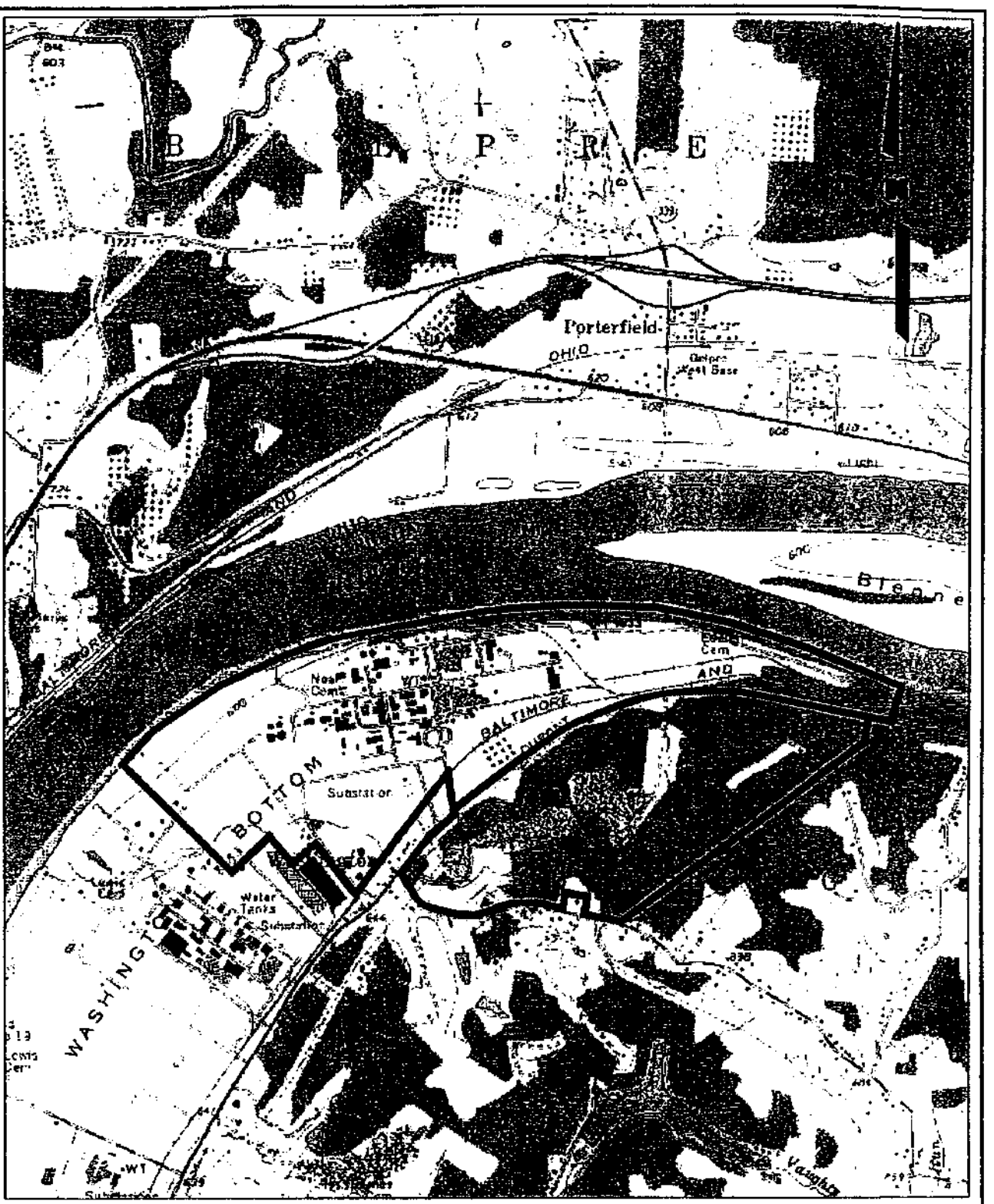
a) air modeling data from DuPont;
b) air modeling data from WVDEP;
c) water use data from the Well Use Survey;
d) groundwater data from the Groundwater Well Analysis of C8 for residential wells;
e) drinking water data from Lubeck Public Service District wells;
f) any available ATSDR Health Consultation that assesses potential health effects from exposure to C8 in public supply drinking water.

Subtask 4 – TERA shall review the ecological data and determine whether there is sufficient information to support the development of a C8 Screening Level for protection of ecological health

Subtask 5 – TERA shall compile and discuss the results of the above tasks into a comprehensive report (draft and final versions), which also refers to and provides a brief summary of the following:

a) USEPA's Draft Hazard Assessment of C8;
b) DuPont's air modeling data;
c) WVDEP's air modeling data;
d) groundwater data from the Groundwater C8 Analysis and Well Use Survey of Local Residents, and Lubeck Public Service District;
e) ATSDR Health Consultation that assesses potential health effects from exposure to C8 in public supply drinking water, if available.

Additionally, TERA shall include in the report any insights or recommendations for future research gleaned during this process that would further elucidate the toxicity of C8. Also, TERA shall provide in the report a summary discussion of the relevance the carcinogenicity of C8 in rats to humans.

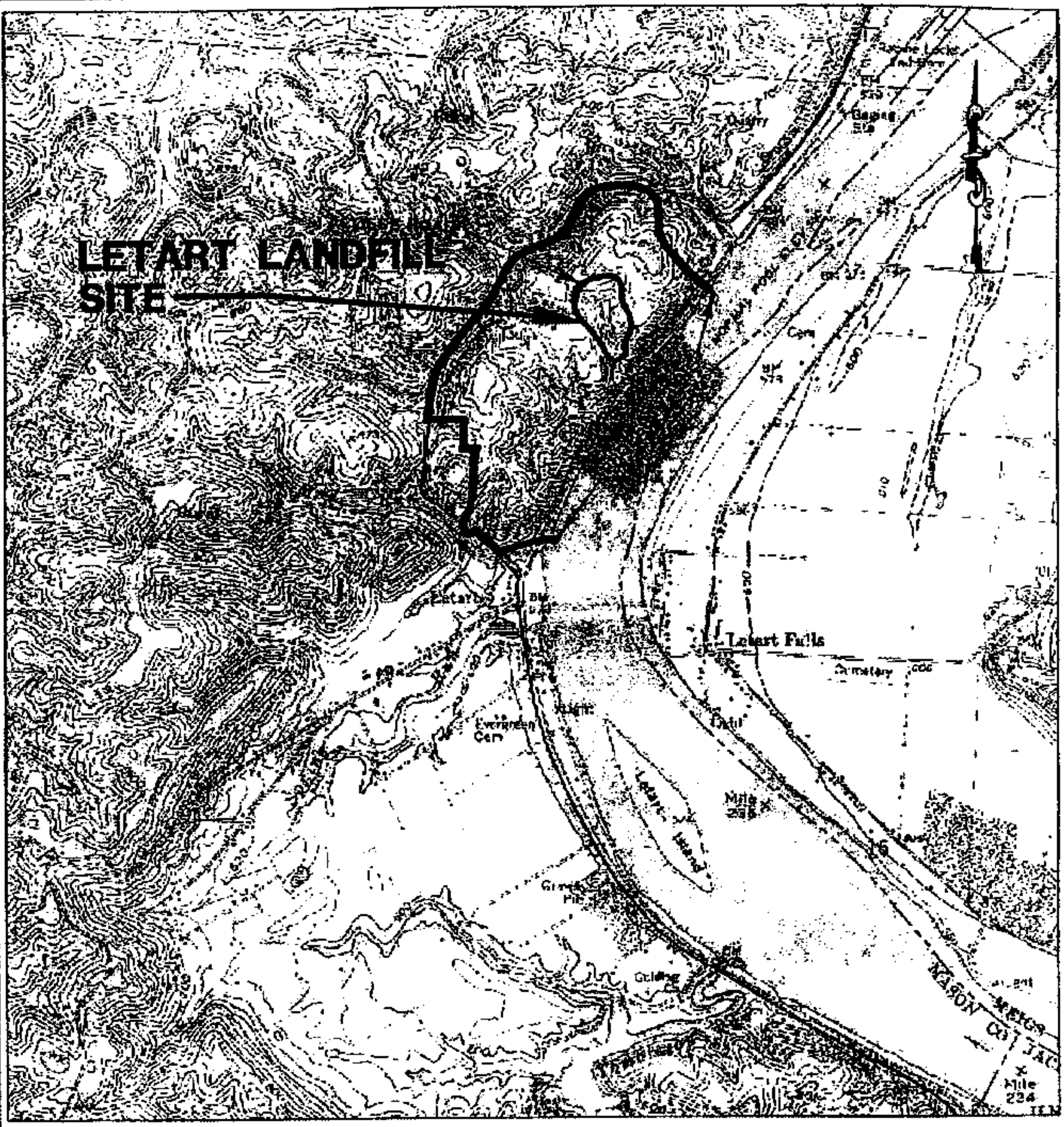


Corporate Remediation Group
An Alliance between DuPont and URS Dianond

SITE LOCATION MAP

DuPont Washington Works
Washington, West Virginia

EXHIBIT 1



SCALE

2000 0 2000'

SOURCE: NEW HAVEN, WV-OHIO QUADRANG

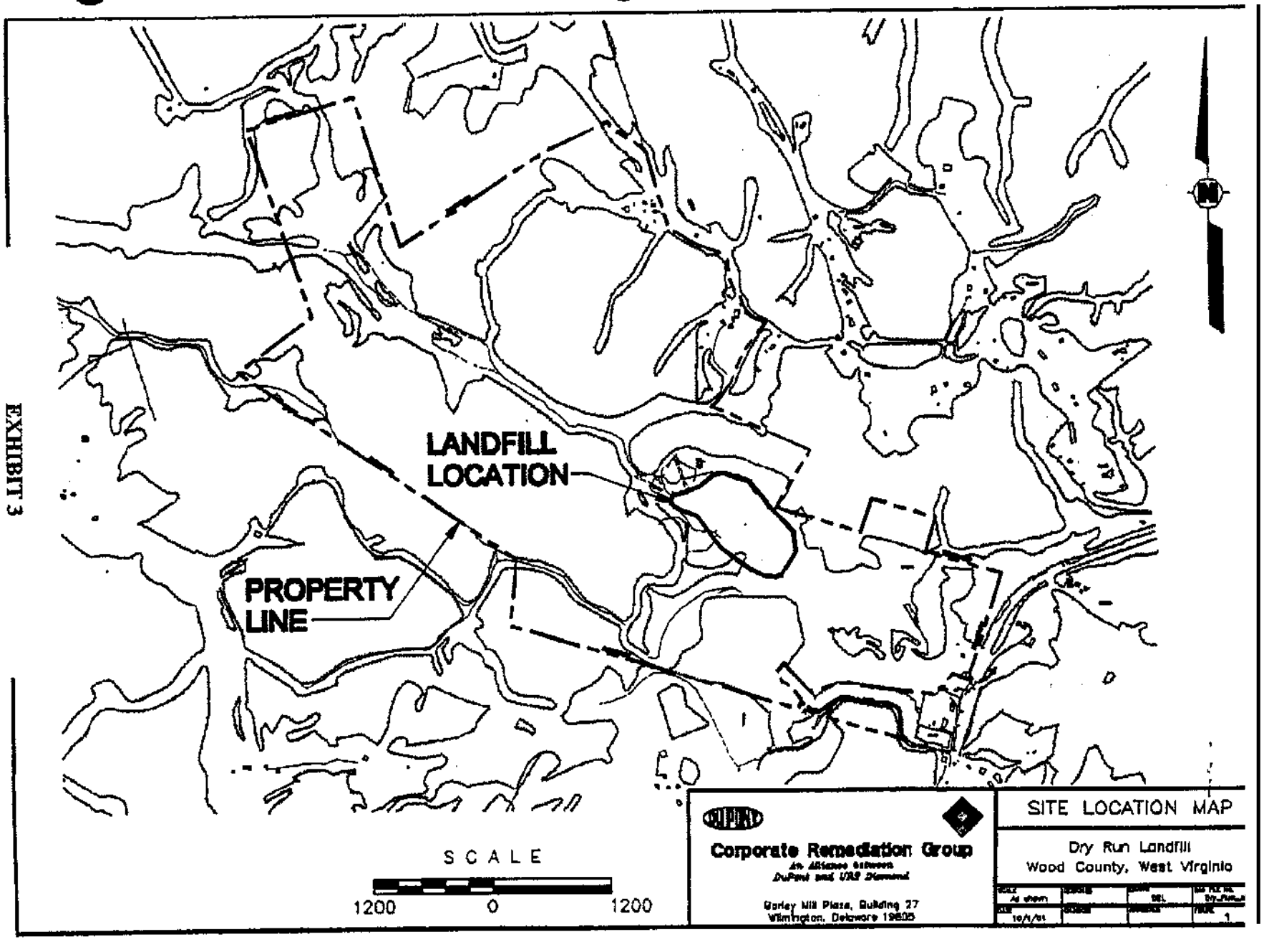
Corporate Remediation Group

EXHIBIT 2

SITE LOCATION MAP

Letart Landfill Site
Parkerburg, WV

EXHIBIT 3



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DRAFT: DEVELOPMENT OF PROVISIONAL ORAL AND INHALATION REFERENCE DOSES AND PRELIMINARY SCREENING LEVELS FOR AMMONIUM PERFLUOROOCTANOATE

A Provisional Oral Reference Dose (PRfDo) of 3 x 10-5E or 0.00003 mg/kg/day for Ammonium Perfluorooctanoate (C8) and a Provisional Inhalation Reference Concentration (PRfCi) of 0.02 $\mu g/m^3$ have been developed by WVDEP. Subsequently, a Preliminary Screening Level (PSLw) for groundwater of 1 ppb was calculated based on this PRfDo and on the model for the water ingestion exposure pathway with default parameters commonly used by USEPA and WVDEP. The PRfCi of 0.02 $\mu g/m^3$ would serve as the Preliminary Screening Level (PSLi) for air. The scientific rationale used to develop the PRfCi and the PRfDo, and to calculate the PSLw is described below.

Development of the Provisional Oral Reference Dose:

Ammonium perfluorooctanoate (C8 or APFO) is a potent synthetic surfactant. In biologic media, the ammonium quickly dissociates. C8, as perfluorooctanoic acid (PFOA), comprises 93 – 98% of FC-143 FLUORAD Brand Fluorochemical Surfactant. Toxicity studies have been conducted on APFO, PFOA, and FC-143. The USEPA has conducted a literature search and review of toxicological data regarding PFOA; their findings are summarized in the Draft Hazard Assessment of PFOA (in preparation). This document, including supporting references, and information provided to WVDEP by DuPont, and the data contained on 7 compact discs as part of the TSCA submittal by 3M were the major sources of toxicological information utilized in the development of the reference doses.

The first step in the development of a reference dose is to identify appropriate exposure studies. Chronic studies utilizing the appropriate route of exposure and animal model are most highly desirable. However if such studies are not available, then subchronic studies utilizing other routes of exposure may be employed for reference dose development by including additional uncertainty factors. Ideally a NOAEL, No Observable Adverse Effect Level, was determined in the study; however, if a NOAEL was not determined, then a LOAEL, Lowest Observable Adverse Effect Level, may be employed in reference dose development by including an additional uncertaintly factor.

The only chronic oral exposure study available was conducted in male and female rats fed FC-143 over a two-year period (3M, 1987). A LOAEL of 300 ppm (14.2 mg/kg/day for male, and 16.1 mg/kg/day female) was determined in rats based on decreased body weight gains; increased liver and kidney weight; and toxicity in the hematological and hepatic systems. However, a LOAEL for female rates of 30 ppm (1.6 mg/kg/day) was determined based on incidence of ataxia and reversible ovarian tubular hyperplasia.

To date, four 90-day subchronic oral exposure animal studies have been conducted - two in monkeys and two in rats. A LOAEL of 30 ppm (1.72 mg/kg/day) was determined by Goldenthal (1978a) in male rats exposed to a diet including FC-143 based

on increased liver weight; increased blood glucose; and decreased red cell counts. Palazzolo (1993) found a NOAEL of 30 ppm **(1.44** mg/kg/day) and a LOAEL of 100 ppm **(4.97** mg/kd/day) based on decreased body weight and body weight gain, and on increased absolute and relative liver weights with hepatocellular hypertrophy in male rats exposed to PFOA in the diet for 13 weeks.

Goldenthal (1978b) determined **an** oral NOAEL of **3** mg/kg/day in rhesus monkeys. However, this dose group occasionally had soft stools or moderate to marked diarrhea, and frothy emesis. Also, there were trends toward increased glucose levels, and decreased alkaline phosphatase levels in this dose group.

Butenhoff, et al., (2001) found an oral LOEL of 3 mg/kg/day based on increased liver weight in cynomolgus monkeys, which occurred at serum concentrations that overlapped those observed in some workers with high exposure; therefore the liver enlargement was considered to be a significant effect by the authors. **A** NOEL was not determined in this study. Because the monkey is most physiologically similar to humans, as evidenced by the long half-life of C8 in humans (1 – 3.5 years) and monkeys. This LOEL was utilized to estimate an the PRfDo as decribed below:

Calculation of the Oral Provisional Reference Dose:

$$\text{PRfDo} = \frac{\text{LOEL}}{(\text{UFH})\,(\text{UFA})\,(\text{UFS})\,(\text{UFL})\,(\text{MF})}$$

where:
PRfDo = Provisional Oral Reference Dose (mg/kg/day);
LOEL = Lowest Observable Effect Level (mg/kg/day) = 3;
UF = Uncertainty Factors (unitless);
H = intrahuman variability accounts for variation in sensitivity among the human population =10;
A = animal to human extrapolation = 10;
S = extrapolation from subchronic exposure to chronic exposure = 10;
L = extrapolation from a LOEL to a NOEL = 10;
D = insufficiency in the toxicological database = 3;
MF = Modifying Factor (unitless) = 3

A modifying factor of 3 was used because of the following characteristics of C8:

- Long half-life in humans (approximately 1 – 3.5 years);
- Potential for bioaccumulation;
- Potential for biopersistence;
- Unusual physical properties such as solubility and partition coefficient.

Therefore. the PRfDo equals 3 **x** 10E-5.

Calculation of the Preliminary Screening Level for C8 in Water:

The PSL of 1 µg/L or ppb was calculated using a Hazard Quotient of 1 and the following equation and default parameters:

$$GW = \frac{(PRfDo)(BWa)(CF)}{(IRWa)}$$

where:

GW = concentration in Groundwater (µg/L);
PRfDo = Provisional Oral Reference Dose (mg/kg/day) = 3 x 10E-5;
BWa = adult body weight (kg) = 70;
CF = conversion factor (from mg to µg) = 1000;
IRWa = Ingestion Rate of Water for an adult (L/day) =2.

Development of Provision Inhalation Reference Concentration:

No monkey inhalation exposure studies have been conducted for PFOA. However, two two-week (6 hr/day; five days/week) inhalation exposure studies were conducted in rats by DuPont (1994). In the first study, a LOAEL of 11 mg/m^3 was found based on decreased body weight and hepatic injury. In the second study, a NOAEL of 1 mg/m^3 was determined. This NOAEL agreed with a NOAEL of I mg/m3 found by Staples et al. (1984) in female rats during a developmental toxicity study of PFOA. Inhalation reference doses were calculated for the NOAEL and the LOAEL as described below.

Based on the LOAEL:

Conversion from intermittent exposure to continuous exposure:

LOAEL = E x D (h/24h) x W (days/7 days)

Where:
LOAEL = 11 mg/m^3;
E = exposure level in mg/m^3;
D = hours of exposure (6);
W = days of exposure (5);

Thus the continuous exposure LOAELc = 1.95 mg/m^3;

$$PRfCi = \frac{LOAELc}{(UFH)(UFA)(UFS)(UFL)(MF)}$$

where:
PRfCi = Provisional Inhalation Reference Concentration (mg/m^3);
LOAELc = Lowest Observable Effect Level (mg/m^3) = 11;
UF = Uncertainty Factors (unitless);
H = intrahuman variability accounts for variation in sensitivity among the human population =10;
A = animal to human extrapolation = 10;
S = extrapolation from subchronic exposure to chronic exposure = 10;
L = extrapolation from a LOEL to a NOEL = 10;
D = insufficiency in the toxicological database = 3;
MF = Modifying Factor (unitless) = 3
A modifying factor of 3 was used because of the following characteristics of C8:

- Long half-life in humans (approximately 1 – 3.5 years);
- Potential for bioaccumulation;
- Potential for biopersistence;
- Unusual physical properties such as solubility and partition coefficient.

Therefore, the PRfCi equals $0.022 \mu g/m^3$ based on the LOAEL of $11 mg/m^3$.

Based on the NOAEL:

Conversion from intermittent exposure to continuous exposure:

NOAEL = E x D (h/24h) x W (days/7 days)

Where:
NOAEL = $1 mg/m^3$;
E = exposure level in mg/m^3;
D = hours of exposure (6);
W = days of exposure *(5);*

Thus the continuous exposure NOAELc = $0.18 mg/m^3$;

$$PRfCi = \frac{NOAELc}{(UFH)\,(UFA)\,(UFS)\,(UFL)\,(MF)}$$

where:
PRfCi = Provisional Inhalation Reference Concentration (mg/m^3);
NOAELc = No Observable Effect Level (mg/m^3) = 1;
UF = Uncertainty Factors (unitless);
H = intrahuman variability accounts for variation in sensitivity among the human population =10;
A = animal to human extrapolation = 10;
S = extrapolation from subchronic exposure to chronic exposure = 10;
D = insufficiency in the toxicological database = 3;

MF = Modifying Factor (unitless) = 3

A modifying factor of 3 was used because of the following characteristics of C8:

- Long half-life in humans (approximately 1 – 3.5 years);
- Potential for bioaccumulation;
- Potential for biopersistence;
- Unusual physical properties such as solubility and partition coefficient.

Therefore, the PRfCi equals 0.02 $\mu g/m^3$ based on the NOAEL of 1 mg/m^3. The PRfCi estimated using the NOAEL and the LOAEL are approximately equal.

References:

Butenhoff, J.L. et al. 2001. Toxicity of ammonium perfluorooctanoate (APFO) in cynomolgus monkeys after twenty-six weeks of oral dosing (in preparation).

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Goldenthal, E.I. 1978a. Ninety Day Subacute Rat Toxicity Study. Final Report. Prepared for 3M, St. Paul, Minnesota, by International Research and Development Corporation, St. Paul, Minnesota, November 6, 1978.

Goldenthal, E.I. 1978b. Ninety Day Subacute Rhesus Monkey Toxicity Study. Final Report. Prepared for 3M, St. Paul, Minnesota, by International Research and Development Corporation, St. Paul, Minnesota, November 10, 1978.

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Olsen, GW; Gilliland, FD; Burlew, MM; **Bums,** JM; Mandel, JS; Mandel, JH. 1998a. An epidemiologic investigation of reproductive hormones in men with occupational exposure to perfluorooctanoic acid. JOEM 40(7):614-622.

Olsen, GW; Burris, JM; Burlew, MM; Mandel, JH. 1998b. ***An*** Epidemiologic Investigation of Plasma Cholecystokinin and Hepatic Function in Perfluorooctanoic Acid Production Workers. Final Report. 3M Company.

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Staples, R.E., Burgess, **B.A.,** and Kerns, W.D. 1984. The Embryo-Fetal Toxicity and Teratogenic Potential of Ammonium Perfluorooate (APFO) in the Rat. Fund. Appl. Tox. 4,429-440.

AR 226 - 1127

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UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

SEP 27 2002

OFFICE OF
PREVENTION PESTICIDES AND
TOXIC SUBSTANCES

MEMORANDUM

SUBJECT: Revision of PFOA Hazard Assessment and Next Steps

FROM: Charles M. Auer, Director
Office of Pollution Prevention and Toxics

TO: Oscar Hernandez, Director
Risk Assessment Division

Mary Ellen Weber, Director
Economics, Exposure, and Technology Division

Ward Penberthy, Acting Director
Chemical Control Division

2002 OCT -8 AM 11:23

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As part of the effort by the Office of Pollution Prevention and Toxics (OPPT) to understand health and environmental issues presented by fluorochemicals in the wake of unexpected toxicological and bioaccumulation discoveries with respect to perfluorooctyl sulfonates (PFOS), OPPT has been investigating perfluorooctanoic acid and its salts (PFOA). OPPT released a preliminary ***Draft Hazard*** Assessment ***of Perfluorooctanoic Acid and Its Salts,*** dated February 20,2002, on March **28,2002,** and issued a minor correction to that document on April **15,2002.** That draft assessment indicated potential systemic toxicity and carcinogenicity, and observed that blood monitoring data suggested widespread exposure to the general population, albeit at low levels. It also noted, however, that additional toxicity studies were underway on other endpoints and that further data would be available within a matter of months.

The Agency has since received considerable additional data. The additional toxicology data submitted to the Agency suggest a potential for reproductive/developmental toxicity, and additional blood sample analysis data indicate low level exposures to the general population that are unexplained at this time.

Stephen Johnson, Assistant Administrator of the Office of Prevention, Pesticides, and Toxic Substances (OPPTS), met with representatives from the manufacturers and users of PFOA and related chemicals on August 13,2002. He requested continued discussion with

manufacturers and users of PFOA and related chemicals to further investigate these issues, and raised the importance of and need for communicating with the public. Following that meeting, OPPTS met with toxicologists from industry on August 30, 2002, to discuss the recent study submissions and any additional anticipated work. OPPT also met by conference call with manufacturer representatives on September 12,2002 to explore existing exposure information and identify gaps in those data that may help to explain the presence of PFOA in the blood of the general population. Summaries of these meetings are being placed in the public administrative record for this investigation, AR-226: PFOS, PFAS, PFOA, Telomers, and Related Chemicals.

An interim revised hazard assessment updating the original *Draft Hazard Assessment* to incorporate OPPT's reviews of these data has been prepared. As soon as this document completes internal review procedures, it should be placed in AR-226. Please proceed to finalize this interim revised hazard assessment within the next four to six weeks, at which time we will place the document in the public file.

The reproductive/developmental toxicity data, the carcinogenicity data, and the blood monitoring data reviewed in the interim revised hazard assessment raise the possibility that PFOA might meet the criteria for action under section 4(f) of the Toxic Substances Control Act.

The Agency established a process in 1991 for determining whether the TSCA §4(f) criteria are met, and published that process in a *Federal* Register notice concerning refractory ceramic fibers (RCF) (56 FR 58693; November 21,1991). With this memo, I am requesting that you now initiate a priority review, as described in that notice, to determine the significance of the risks presented by PFOA and its salts. This priority review should begin while you proceed with the finalization of the interim revised hazard assessment. It is my understanding that you have also initiated a request with the Science Advisory Board (SAB) for a peer review of the preliminary risk assessment focused on developmental/reproductive toxicity that will be developed based on this priority review.

It is my expectation that the hazard assessment priority review will be completed in the next four to six weeks. Please be prepared to discuss these issues when we meet with the Assistant Administrator on next steps

cc: S. Johnson
S. Hazen
M. Schneider
Administrative Record AR-226: PFOS, PFAS, PFOA, Telomers, and Related Chemicals

AR 226_1129

3pl

Oscar Hernandez

09/27/02 02:32 PM

To: Vanessa Vu/DC/USEPA/US@EPA
cc: Robert Flaak/DC/USEPA/US@EPA, Charles Auer/DC/USEPA/US@EPA, Margaret Schneider/DC/USEPA/US@EPA, Seed.Jennifer@EPAMAIL.EPA.GOV@EPA, Barbara Leczynski/DC/USEPA/US@EPA, Priscilla Flattery, Robert Perlis/DC/USEPA/US@EPA
Subject: SAB request

Vanessa, attached is a request for an SAB review of a preliminary risk assessment of Perfluorooctanoic acid (PFOA). We will work with SAB staff to assemble the formal submission. Thank you for your help.

2002 OCT 17 AM 10:30

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Science Advisory Board
Proposed Project

1. Project Title / Subject: Preliminary Risk Assessment of Perfluorooctanoic Acid

2. Requesting Organization /Office: Office of Pollution Prevention and Toxics (OPPT)

3. Requesting Official: Oscar Hernandez, Director, Risk Assessment Division, OPPT

4. General Ranking: High within the Agency; High within OPPTS; High within OPPT

5. Applicable Goal, Objective, and Subobjective: Goal 4, 4.3.2,

6. Legal Obligation / Directive (if any): Toxic Substances Control Act (TSCA)

7. Endorsement by other offices: Not Solicited

8. Program Contact: Jennifer Seed, OPPT/RAD (7403M), 202-564-7634,
US EPA, 1200 Pennsylvania Ave., NW, Washington DC, 20460

9. Background: As part of the effort by the Office of Pollution Prevention and Toxics (OPPT) to understand health and environmental issues presented by fluorochemicals in the wake of unexpected toxicological and bioaccumulation discoveries with respect to perfluorooctane sulfonates (PFOS), OPPT has been investigating perfluorooctanoic acid and its salts (PFOA). OPPT released a preliminary *Draft Hazard Assessment of Perfluorooctanoic Acid and Its Salts,* dated February 20; 2002, on March 28, 2002, and issued a minor correction to that document on April 15, 2002. That draft assessment indicated potential systemic toxicity and carcinogenicity, and observed that blood monitoring data suggested widespread exposure to the general population, albeit at low levels. It also noted, however, that additional toxicity studies were underway on other endpoints and that further data would be available within a matter of months.

Numerous studies conducted by industry on PFOA and its salts have included toxicological studies in rodents and monkeys, biomonitoring studies of workers and the general US population, epidemiology studies, and biomonitoring studies of the wildlife in the US. These studies have shown that PFOA is also highly persistent in the environment and does not hydrolyze, photolyze or biodegrade under environmental conditions. PFOA is also highly persistent in humans, is not metabolized and has a half life of several years. The biomonitoring studies have shown that it is present in the general US population and the wildlife. At present, the sources and pathways of exposure are unknown. Toxicological studies in rodents and primates have shown that exposure to PFOA can result in a variety of effects including developmental/reproductive toxicity, liver toxicity and cancer.

Given that PFOA is present in the general US population and its toxicological profile, OPPT determined the need to conduct a risk assessment. This preliminary risk assessment places emphasis on the developmental/reproductive endpoints. The tumors (liver, pancreas and Leydig cell) observed in the cancer bioassays are thought to be directly or indirectly related to

the activation of PPARα. The relevance of this mode of action to humans is currently under scientific debate. The ILSI Risk Science Institute, under a cooperative agreement with EPA, has formed several workgroups to assess the state of the science which will be presented at a public workshop. The risk assessment of PFOA will be extended to include the systemic toxicity and cancer data once there is resolution of this issue.

10. Why the SAB Should Review this Project: This preliminary risk assessment utilized a margin of exposure (MOE) approach. Since there is no information available on the source or pathway(s) of human exposure, the preliminary risk assessment of PFOA utilized serum levels which were available for the general human population and were available for the rat toxicology studies. Since this preliminary risk assessment is of high priority with respect to Agency relevance, SAB review and comment is being sought. A scientifically sound assessment would play an important role in the analysis of options by the program offices.

11. Type of SAB Activity Requested: Peer review.

12. Tentative Charge: Review of the preliminary risk assessment with special emphasis on (a) the use of serum data as a measure of internal dose; (b) the use of serum levels from parental animals as a surrogate for levels in offspring; (c) the use of the data to provide a range of possible MOEs; (d) other assumptions that were made. A more detailed charge will be negotiated with SAB at a later date.

13. Tentative Schedule and Committee: Winter, 2003. Environmental Health Committee.

14. Principal Interested and Affected Parties: Fluoropolymer Manufacturers Group, Telomers Research Program, State of West Virginia, Region 3

15. Budget: The development of this preliminary risk assessment and the background hazard assessment was done by OPPT scientists during FY01 - FY02. An estimated 3 FTEs were required. No intramural or extramural funds were used.

16. Past Peer Reviews: None

17. Quality Management / Quality Assurance: This preliminary assessment has been through the following components of the Office's quality system: internal branch review, review through the management hierarchy, including Division and Office review.

18. Preparer: Jennifer Seed, OPPT/RAD, 202-564-7634

Date: September 23, 2002