National Advisory Committee for Acute Exposure Guideline Levels for Hazardous Substances

NAC/AEGL-36
April 12-14, 2005

U.S. EPA, Office of Research and Development
Building C, Auditorium
109 T.W. Alexander Drive
Research Triangle Park, NC 27709

AGENDA

Tuesday, April 12, 2005

9:00 a..m.	Introductory remarks and approval of NAC/AEGL-35 Highlights (George Rusch, Ernie Falke, and Paul Tobin)
9:15	Review of NAS/COT-15, February, 2005 Process Issues (Ernie Falke and George Rusch) SOP Issues (Iris Camacho)
11:15	Revisit of Allyl Alcohol- COT comments (Claudia Troxel)
12:00 p.m.	Lunch
1:00	Discussion of PBPK SOP White Paper (Jim Dennison/Claudia Troxel)
2:15	AEGL Chemical Priority List/Database Update (Paul Tobin)
3:00	Break
3:15	Revisit of Iron Pentacarbonyl- COT Comments (Ernie Falke/Bob Young)
3:30	Review of Methyl t-butyl ether (Steve Barbee/Dana Glass)
5:30	Adjourn for the day

Wednesday, April 13, 2005

8:30 a.m.	Revisit of Ammonia- COT Comments (Susan Ripple/Kowetha Davidson)
9:30	Review of Hexafluoroacetone (Paul Tobin/Bob Young)
10:30	Break
10:45	Review of Aluminum Phosphide (Ernie Falke/Cheryl Bast)
11:45	Revisit of Epichlorohydrin- FR08 comments (Richard Thomas/Kowetha Davidson)
12:15	Lunch
1:30	Revisit of Nitrogen Mustards (Richard Thomas/Bob Young)
2:30	Review of Methyldichlorosilane and Methylchlorosilane (Ernie Falke/Cheryl Bast)
3:30	Break
3:45	Revisit of Acrylic Acid- COT comments (Ernest Falke/Peter Griem/Ursula Gundert-Remy)
5:30	Adjourn for the day

Thursday, April 14, 2005

8:00 a.m.	Review of Diketene (Warren Jederburg/Kowetha Davidson)
9:45	Break
10:00	Revisit of Acetone- FR08 comments (Nancy Kim/Jens-Uwe Voss/Ursula Gundert-Remy)
11:00	Revisit of Sulfur Dioxide- COT comments (Cheryl Bast)
11:30	Administrative matters
12:00 noon	Adjourn meeting

NAC/AEGL Meeting 36: April 12-14, 2005

ATTACHMENT 2

Chemical: **CAS Reg. No.:**

Action: Proposed_____ **Interim**_____ **Other**_____ taken by MDking

Chemical Manager:

Staff Scientist:

NAC Member	4/12	4/13	4/14	LOA
[redacted]				
Steven Barbee	SB	SB	SB	
Lynn Beasley	LB	LB	LB	
Robert Benson	BB	BB	BB	
Jonathan Borak	JB	JB	left @ 2:05pm 4/13/05	
William Bress	—	—	—	
George Cushmac	GC	GC	GC	
Ernest Falke	EF	EF	EF	
Alfred Feldt	—	—	—	
John Hinz	JH	JH	JH	
Jim Holler	—	—		
Tom Hornshaw	TH	TH	TH	
Warren Jederberg	—	—	—	
Bob Young	ORNL	ORNL	ORNL	
Dana Glass	ORNL	ORNL	ORNL	
Kynaston D	ORNL	ORNL	ORNL	
CHERYL Bast	ORNL	ORNL	ORNL	

NAC Member	4/12	4/13	4/14	LOA
[redacted]				
Nancy Kim	NK	NK	NK	
Glenn Leach	—	—	—	
John Morawetz	JM	JM	JM	
Richard Niemeier	RN	RN	RN	
Marinelle Payton	—	—	—	
Susan Ripple	SR	SR	SR	
George Rodgers	GR	GR	GR	
Marc Ruijten	MR	MR	MR	
George Rusch, Chair	GR	GR	absent	
Richard Thomas	RT	RT	RT	
George Woodall	GW	GW	GW	
Ursula Kenyon	✓	✓		
Roberta Grant	prospective member			
TALLY	16/23	17/23	15/23	
PASS/ FAIL	74%	74%		

% = Quorum
2/3 vote BQ to pass
(67)

4/12/05 Claudia T. Jim Denison ~~Cheryl Bast~~

PPM, (mg/m³)	10 Min	30 Min	1 Hr	4 Hr	8 Hr
AEGL 1	,( )	,( )	,( )	,( )	,( )
AEGL 2	,( )	,( )	,( )	,( )	,( )
AEGL 3	,( )	,( )	,( )	,( )	,( )
LOA					
* = ≥10% LEL					
** = ≥ 50% LEL					
*** = ≥100% LEL					

Thank You note to Christine
Brought TAH

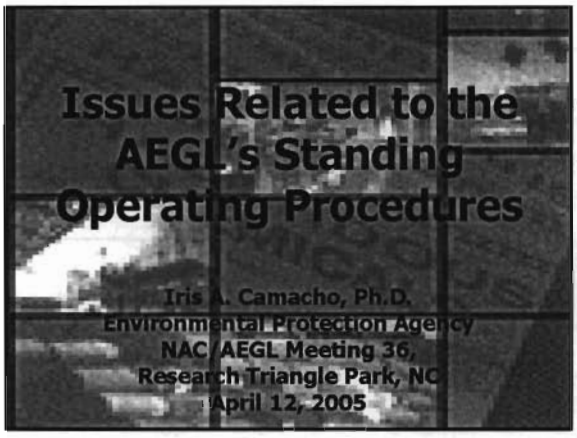
*Safety considerations against the hazard(s) of explosion(s) must be taken into account.
** and ***Extreme safety considerations against the hazard(s) of explosion(s) must be taken into account.

4/12 suggests
* Gene McConnell * Gary Foreman 4/13/05 * Bill Herz, Fertilizer Institute
* Shawn Schopp

NR= Not Recommended due to_____

AEGL 1 Motion by:_____ **Second by:**_____
AEGL 2 Motion by:_____ **Second by:**_____
AEGL 3 Motion by:_____ **Second by:**_____
LOA Motion by:_____ **Second by:**_____

Approved by Chair: _____ **DFO:** _____ **Date:** 4/12/05



Outline of Presentation

SOP Issues

- Time Scaling: Rounding of n
- Adjustment of Uncertainty Factors (UFs)

Time Scaling

Issue

- Rounding of n

NAS recommendation

- Round n to 2 significant figures
- If the 3rd significant figure is 5, round up
  e.g. 1.25 → 1.3

Factors Influencing Modification of UFs

1) **Database-derived UFs**

   Example: similarity of toxicity values across species, mode and/or site of action, etc.

2) **Weigh-of-evidence evaluation of AEGL values**

   Example: AEGL-3 values at levels tolerated by humans support adjustment of total UF to be consistent with supporting data

Adjustment of UFs

Issue

- Discuss approaches to improve UF rationales when uncertainty factors are changed based upon an evaluation of the supporting data

CURRENT APPROACH

	Case#1	Case#2	Case#3
Interpecies UF	3	3	10 → 3
Intrapecies UF	3	10 → 3	3
Total UF	3x3= 10	30 →10	30 → 10

	Case#1	Case#2	Case#3
Interpecies Rationale	Explain why 3 was chosen	Explain why 3 was chosen	Explain decrease from 10 to 3 due to conflict of derived values with supporting data
Intrapecies Rationale	Explain why 3 was chosen	Explain decrease from 10 to 3 due to conflict of derived values with supporting data	Explain why 3 was chosen
Total Rationale	Multiplication of individual factors	Is it better to explain decrease in total UF rationale?	Is it better to explain decrease in total UF rationale?

SOP- Interspecies UFs

2.5.3.2. A Selected UF Applied to Animal Data Driving the AEGL-2 or -3 to a Value Tolerated by Humans Without Lethal or Serious Adverse Effects

When the application of an interspecies UF of 10 reduces the AEGL-3 value (the threshold for lethality) or the AEGL-2 value (the threshold for irreversible or disabling effects) to an exposure concentration that humans are known to tolerate without adverse effect, the interspecies UF is reduced to 3 or 1.

The rationale for the selection of a UF should include the following:

1. Citations and explanations of the human data and how it relates to the AEGL value derived with a UF selected on the basis of the existing guidelines.

SOP- Intraspecies UFs

2.5.3.4.6 UFs That Result in AEGL Values That Conflict with Actual Human Exposure Data

When AEGL values are initially derived, the candidate range of values is compared with the known spectrum of supporting data on the chemical. In a weight-of-the-evidence approach, conflicts between the candidate AEGLs (generally derived from animal data) and the supporting data (either animal data or human data) may lead to the conclusion that the UFs utilized in the calculations are inappropriate, because they conflict with other specific and highly relevant human data. In that case, the candidate AEGLs are revised to reflect the supporting data. In other cases in which the AEGL may conflict with an existing standard or guideline, the comparative basis of the two values may be evaluated to see if the discrepancy is justified or resolvable.

The rationale for the selection of this UF should include the following:

1. A statement on why the use of UFs initially selected conflicts with the published evidence.

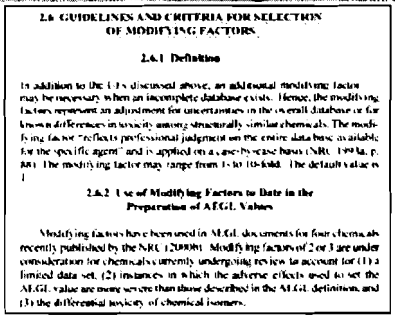
Where is it more appropriate to adjust the UFs based upon a weight-of-evidence evaluation of the supporting data?

In the inter-/intraspecies UF rationale?

In the total UF rationale?

COT Recommendation

- **Use SOP's recommended default UFs or data-derived UFs**
- **Adjust AEGL values with a modifying factor (MF) applied to total UF**



2.6 GUIDELINES AND CRITERIA FOR SELECTION OF MODIFYING FACTORS

2.6.1 Definition

In addition to the UFs discussed above, an additional modifying factor may be necessary when an incomplete database exists. Hence, the modifying factors represent an adjustment for uncertainties in the overall database or for known differences in toxicity among structurally similar chemicals. The modifying factor "reflects professional judgment on the entire data base available for the specific agent" and is applied on a case-by-case basis (NRC, 1994a, p. 88). The modifying factor may range from 1- to 10-fold. The default value is 1.

2.6.2 Use of Modifying Factors to Date in the Preparation of AEGL Values

Modifying factors have been used in AEGL documents for four chemicals recently published by the NRC (2000b). Modifying factors of 2 or 3 are under consideration for chemicals currently undergoing review to account for (1) a limited data set, (2) instances in which the adverse effects used to set the AEGL value are more severe than those described in the AEGL definitions, and (3) the differential toxicity of chemical isomers.

The definition will be revised if MFs are used for adjusting AEGL values based on weight-of-evidence considerations

Weight-of-Evidence Factor (WOEF)

- Definition: An adjustment factor used to revise AEGL derivations based upon a weight-of-evidence evaluation of the supporting data and to make AEGL values consistent with the supporting data. Its magnitude (>0) will depend on the empirical data specific for the chemical under consideration. Values less than 1 should be expressed as a fraction, such as 1/3 or 1/10, to be consistent with the UF progression of 1, 3, and 10, and avoid a repeating decimal.
- The rationale for the selection of the weight-of-evidence factor should include:
  1. Citations and explanations of the supporting human and/or animal data
  2. Justification for the selected factor, including discussion of why the initially derived AEGL values conflict with the published evidence

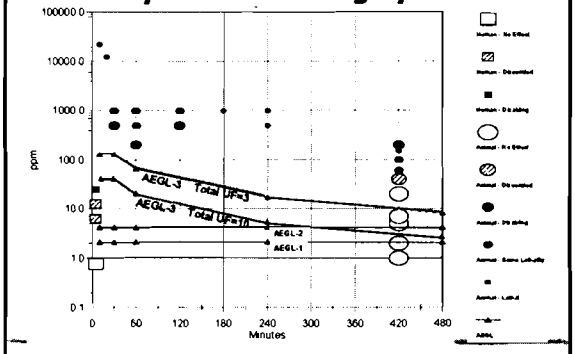
Example: Allyl Alcohol AEGL-3

Interspecies UF and Rationale = 1. The highest concentration causing no mortality was identical in mice, rats, and rabbits (200 ppm for 1hr) and at higher exposures, each of these species had mortality (20-100%). These data suggest little difference between species in response to allyl alcohol exposure. Therefore, the interspecies uncertainty factor was set to 1.

Intraspecies UF and Rationale = 3. Although the traditional approach in a case such as this would argue for an UF of 10 because of the lack of data addressing inter-individual variability, this would result in a composite UF of 10. An UF of 10 would drive the AEGL-3 values to levels inconsistent with available empirical data. A total UF of 10 would result in 1, 4, and 8-hour AEGL-3 values of 20, 5.1, and 2.5 ppm, respectively. Dunlap et al. (1958) reported that rats exposed for 7 hr/d, 5 days/wk for 60 exposures to 1, 2, or 5 ppm had no observable adverse effects, while rats exposed to 20 ppm exhibited only decreased body weight gain. Torkelson et al. (1959a) reported that no adverse effects were noted when rats, guinea pigs, rabbits, and dogs were exposed to 2 ppm for 7 hr/d, 5 d/wk for 28 exposures, while exposure of rats, guinea pigs, and rabbits to 7 ppm for 7 hr/d, 5 d/wk for 134 exposures resulted only in reversible liver and kidney damage.

Total uncertainty factor = 3

Allyl Alcohol: Category Plot



Proposed Approach
Example: Allyl Alcohol AEGL-3

Interspecies UF and Rationale = 1. The highest concentration causing no mortality was identical in mice, rats, and rabbits (200 ppm for 1hr) and at higher exposures, each of these species had mortality (20-100%). These data suggest little difference between species in response to allyl alcohol exposure. Therefore, the interspecies uncertainty factor was set to 1.

Intraspecies UF and Rationale = 10 because of the lack of data addressing inter-individual variability

Total uncertainty factor = 10

Modifying factor = 1/3. A total UF of 10 would drive the AEGL-3 values to levels inconsistent with available empirical data. A total UF of 10 would result in 1, 4, and 8- hour AEGL-3 values of 20, 5.1, and 2.5 ppm, respectively. Dunlap et al. (1958) reported that rats exposed for 7 hr/d, 5 days/wk for 60 exposures to 1, 2, or 5 ppm had no observable adverse effects, while rats exposed to 20 ppm exhibited only decreased body weight gain. Torkelson et al. (1959a) reported that no adverse effects were noted when rats, guinea pigs, rabbits, and dogs were exposed to 2 ppm for 7 hr/d, 5 d/wk for 28 exposures, while exposure of rats, guinea pigs, and rabbits to 7 ppm for 7 hr/d, 5 d/wk for 134 exposures resulted only in reversible liver and kidney damage. Therefore, a MF=1/3 was thought appropriate in order to make AEGL-3 values consistent with the available empirical data.

NEW APPROACH
Example: Allyl Alcohol

UF	UF Value	Rationale
Inter	1	Data-derived
Intra	10	Default
Total	10	Multiplication of individual factors
Adjustment factor (MF or WOEF)	1/3	Weight-of-evidence-derived
Adjusted total UF	10 X 1/3 = 3	

GUIDELINES AND CRITERIA FOR SELECTION OF WEIGH-OF-EVIDENCE ADJUSTMENT FACTORS

Sections 2.5.3.2.8 and 2.5.3.4.6 in the Standing Operating Procedures (SOP) allow for an adjustment to the interspecies and intraspecies uncertainty factors (UF) in order to derive Acute Exposure Guideline Levels (AEGL) values that are consistent with the empirical human and/or animal data. This represents a weight-of-evidence approach to select UF values that generate scientifically credible AEGL values. However, weight-of-evidence considerations may not provide the necessary experimental data to quantitatively allocate the uncertainty factor adjustment between inter- and intraspecies uncertainty factors.

The National Academies (NRC/AEGL Subcommittee) has expressed its concerns on the current weigh-of-evidence approach used to modify the UFs since it is usually not possible to assign the adjustment between the inter- and intraspecies uncertainty factors based upon the available data. As an alternative approach, the NAC/AEGL Committee could select UFs using the criteria stipulated in the SOP which rely on the thorough assessment of experimental data and scientific judment. A weigh-of-evidence assessment is independently conducted following selection of UFs to determine whether or not the AEGL values need to be adjusted with another factor to ensure that the range of AEGL values is consistent with the animal and/or human supporting data. This adjustment could be done with a modifying factor. However, using a modifying factor for such purposes may be inappropriate because the modifying factor is generally used to account for database uncertainties. This adjustment factor could be called the weight-of-evidence factor and be used to revise AEGL derivations based upon a weight-of-evidence evaluation of the supporting data and to make AEGL values consistent with the supporting data.. Its magnitude (>0) will depend on the empirical data specific for the chemical under consideration. Values less than 1 should be expressed as a fraction, such as 1/3 or 1/10, to be consistent with the UF progression of 1, 3, and 10, and avoid a repeating decimal.

The rationale for the selection of the weigh-of-evidence factor should include the following:

1. Citations and explanations of the supporting human and/or animal data
2. Justification for the selected factor, including discussion of why the initially derived AEGL values conflict with the published evidence

The White Paper
Methodology for Incorporating PBPK Modeling Into the AEGL Development Process

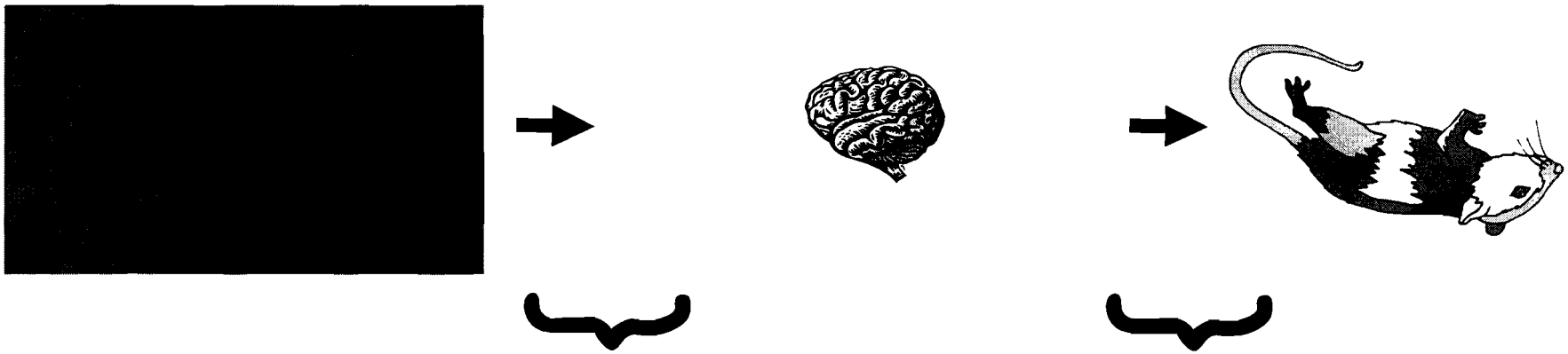
Jim Dennison, CIH, Ph.D.
April 12, 2005

Physiologically Based Pharmacokinetic Modeling (PBPK) Use in Risk Assessment

- Endorsed by USEPA (1994, 2002, 2003) and NAS (1993, 1997)
- Broadly Used in Risk Assessment
  - IRIS, FIFRA, Office of Water, Air, OPP
  - Industry
  - OSHA
- Detailed risk assessments typically use PBPK

Improve the extrapolation of internal doses

Exposure → Internal Dose → Response

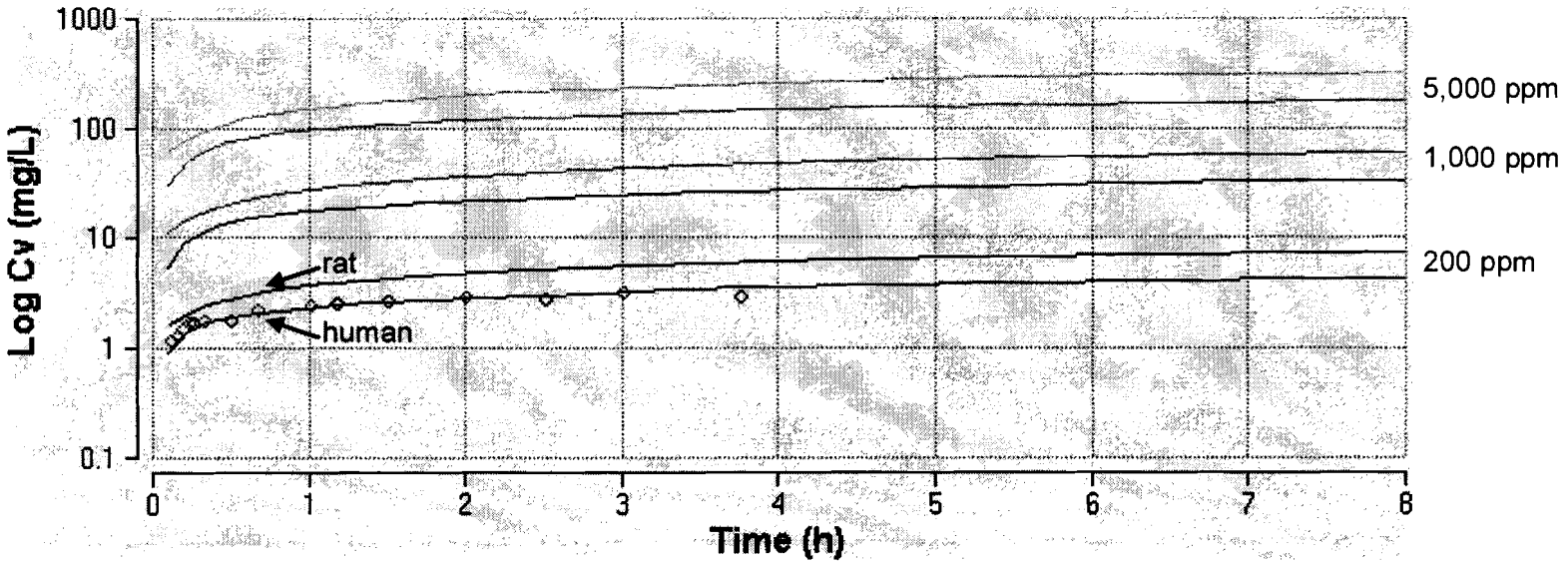


Pharmacokinetics
PBPK Models

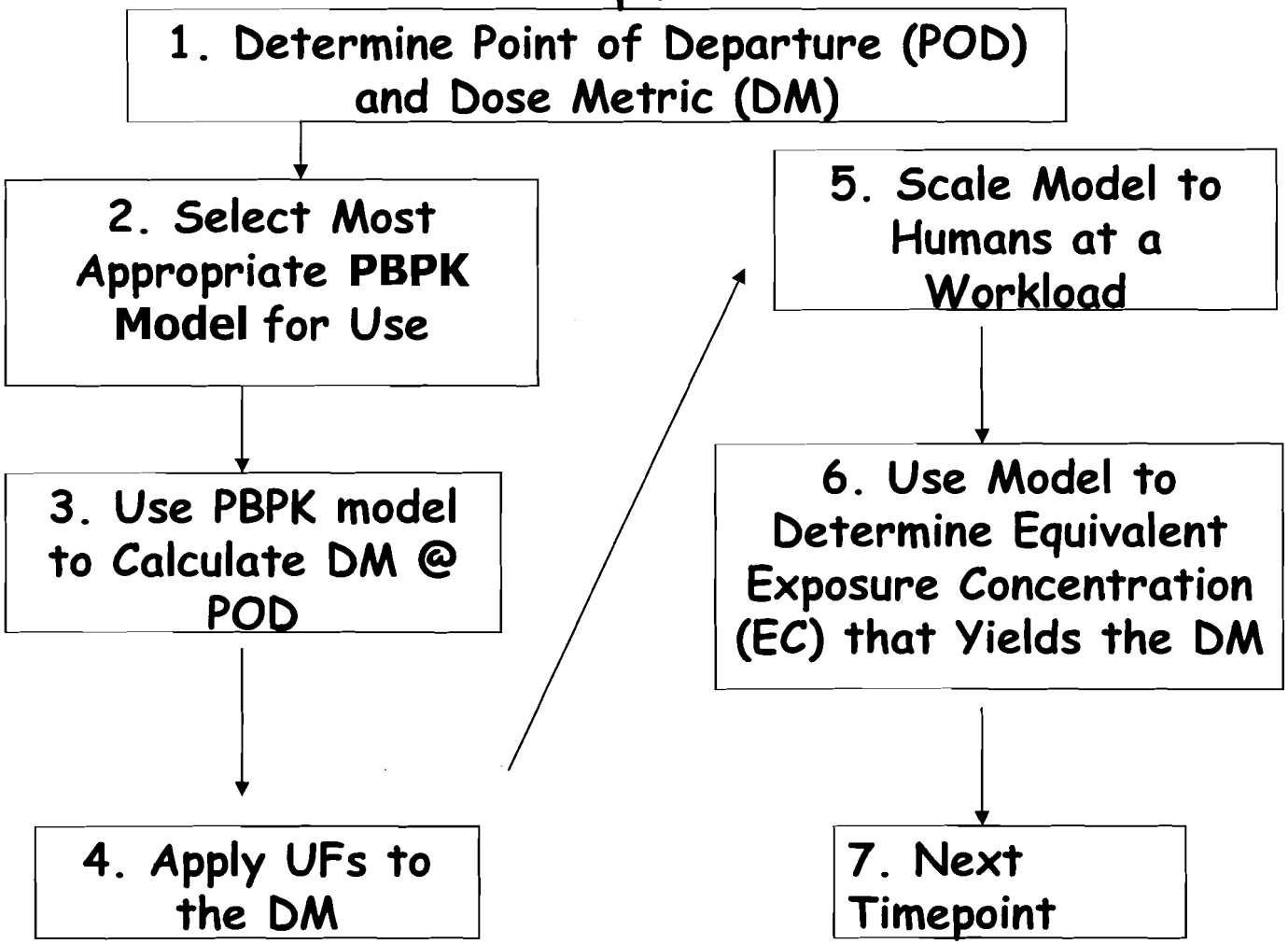
Pharmacodynamics
PBPD Models

Use in AEGL Context

1. Animal to Human PK Extrapolation
2. Temporal Extrapolation
3. Assess Impact of Elevated Activity Level



Use of PBPK Models in AEGL Development



Animal to Human PK

$$AEGL = POD/(UF_A + UF_H)$$

$$UF_A = UF_{A,\,PK} + UF_{A,\,PD}$$

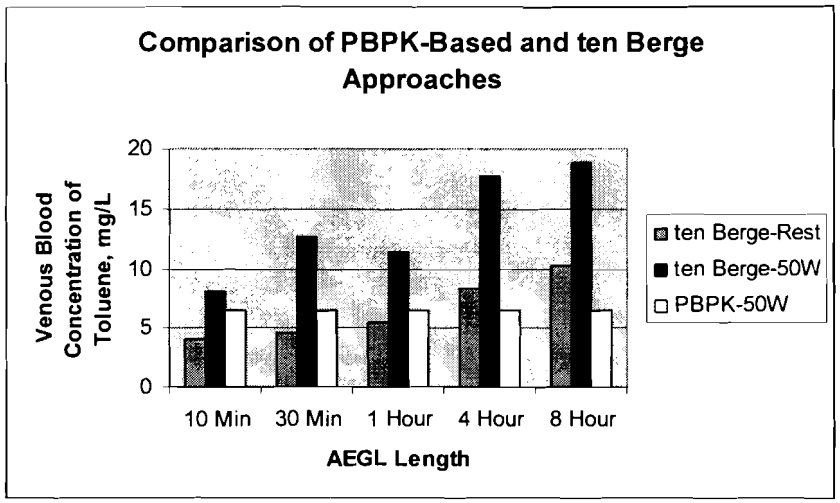
$$AEGL_{PK} = POD_{PK}/(UF_{A,\,PD} + UF_H)$$

The default $UF_{A,\,PK}$ is 3. When PBPK modeling is used, the actual dosimetry is determined by the model in the POD_{PK} and the $UF_{A,\,PK}$ is re-set to 1. The other UFs are retained as they were, unless other kinds of modeling are used as well (which is not very often).

While the PBPK model-based AEGL values are often higher (if the $UF_{A,\,PK}$ is conservative), they can be lower, when this UF is not sufficient.

Temporal Extrapolation

- Flat line
- tenBerge
- PBPK



- PBPK provides a dose-based method for extrapolating to other durations
- PBPK is clearly better able to set values so that the internal dose is same for each exposure duration

Initial Determination of Feasibility

- Chemical manager, author, and modeler should discuss the chemical
- Is there an existing PBPK model?
- Is there a mode of action/dose metric that is model-accessible?
- PBPK justification in the TSD (Y/N)

Model Development

- Evaluate all available models
- Select best one
- Modify if necessary
- Make a final determination whether modeling can be done for the chemical
- Compute the AEGL values

Application of UFs

6. Use Model to Determine the EC that Yields the DM

- If PBPK is used, retain $UF_{A,PD}$ and UF_H
- Can apply to the dose metric or to EC
- If UF_{total} is 3 or 10, difference is slight
- If UF_{total} is 30, applying to EC gives an effective UF of 27-75 (toluene and xylene)
- If applied to dose metric, you have a clear reduction in internal dose

- USEPA and others are still debating this issue
- We recommend applying to the dose metric, for now

Workload– Activity Level

- Selection of an appropriate workload for each AEGL duration

Activity	Input W	Output W *
Bicycling, <10 mph	343	72
Bicycling, 12-13.9 mph, moderate effort	686	144
Conditioning exercise, stationary bike, 50W, very light effort	257	54
Conditioning exercise, stationary bike, 100W, light effort	472	99
Conditioning exercise, stationary bike, 150W, moderate effort	600	126
Conditioning exercise, stationary bike, 200W, vigorous effort	900	189
Conditioning exercise, stationary bike, 250W, very vigorous effort	1072	225
Conditioning exercise, rowing, 50W, light effort	300	63
Carpet sweeping, sweeping floors	214	45
Cleaning, heavy or major	386	81
Inactivity, quiet	86	18
Sleeping	77	16
Standing quietly	103	22
Reclining	86	18
Carrying heavy loads	686	144
Construction	472	99
Sitting- light office work	129	27
Standing, light/moderate activity	257	54
Running, 5 mph	686	144
Running, 10 mph	1372	288
Walking, <2 mph	172	36
Walking, 3 mph	300	63
Walking, 4.5 mph	386	81

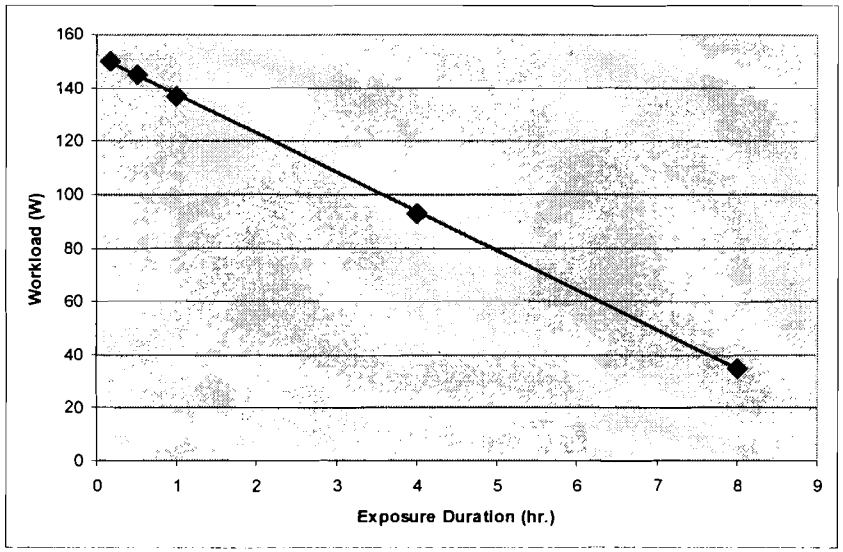
Input workloads for various physical activities

* Assumes 21% efficiency

From PBPK White Paper

Recommended Workloads

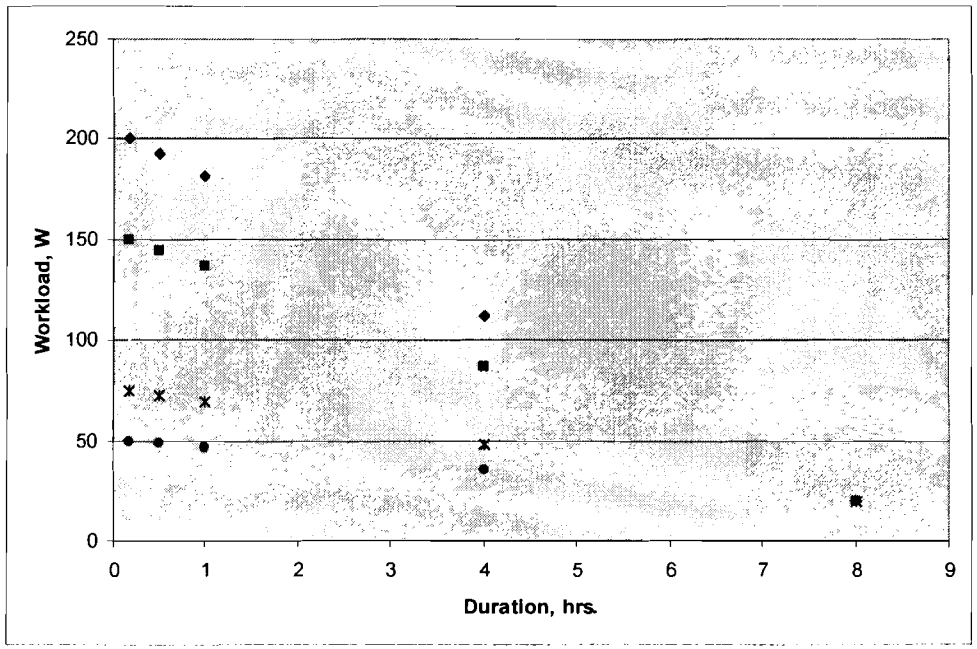
Duration	10 min	30 min	1 hr.	4 hr.	8 hr.
Workload (Output)	150W	145W	137W	93W	35W



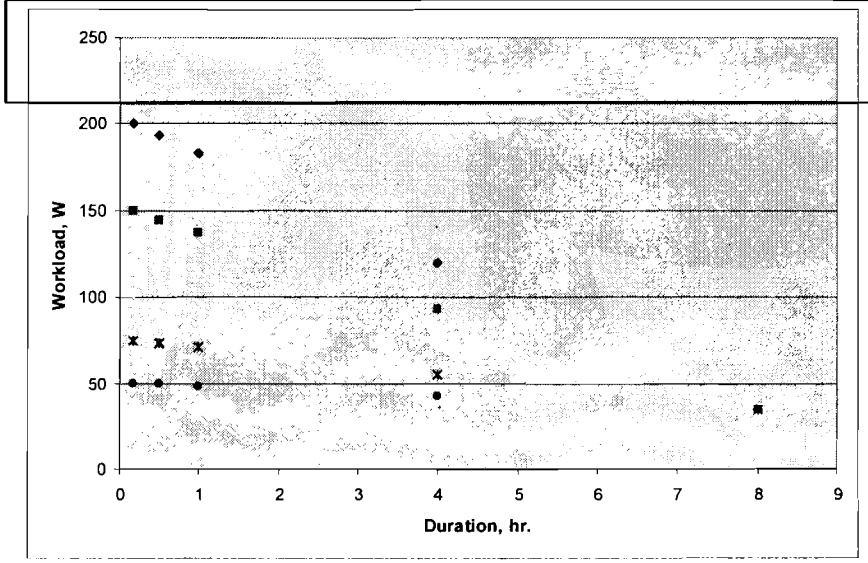
Acknowledgments

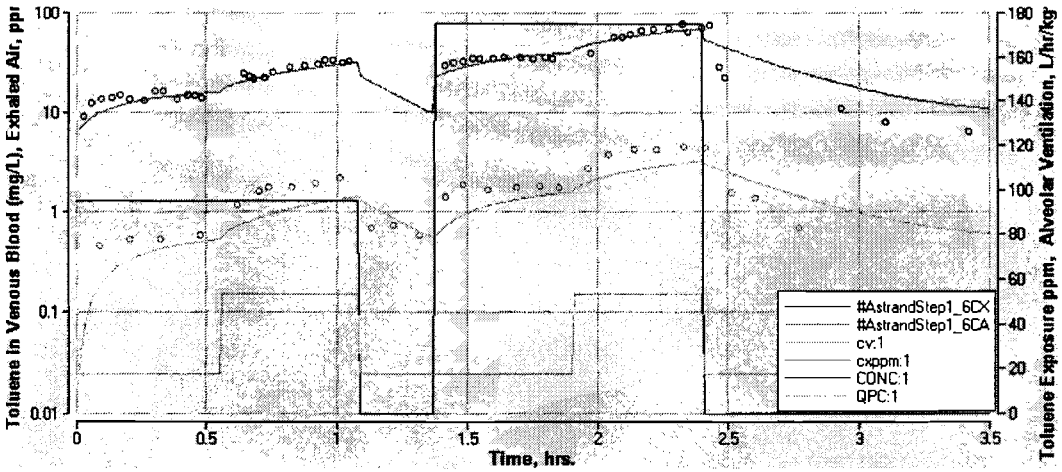
- Claudia Troxel
- USEPA/ORD/NCEA/NHEERL and others at EPA
- ORNL
- Several European colleagues
- Dr. Robert Gotshall (CSU), Dr. Tom Coleman (QCP)

Duration	10 m	30 m	1 hr	4 hr	8 hr
Workload (Output, W.)	200	193	181	112	20
8 hour value taken as a resting state	150	145	136	87	20
	125	120	114	73	20
	100	97	92	61	20
	75	73	69	48	20
	50	49	47	35	20

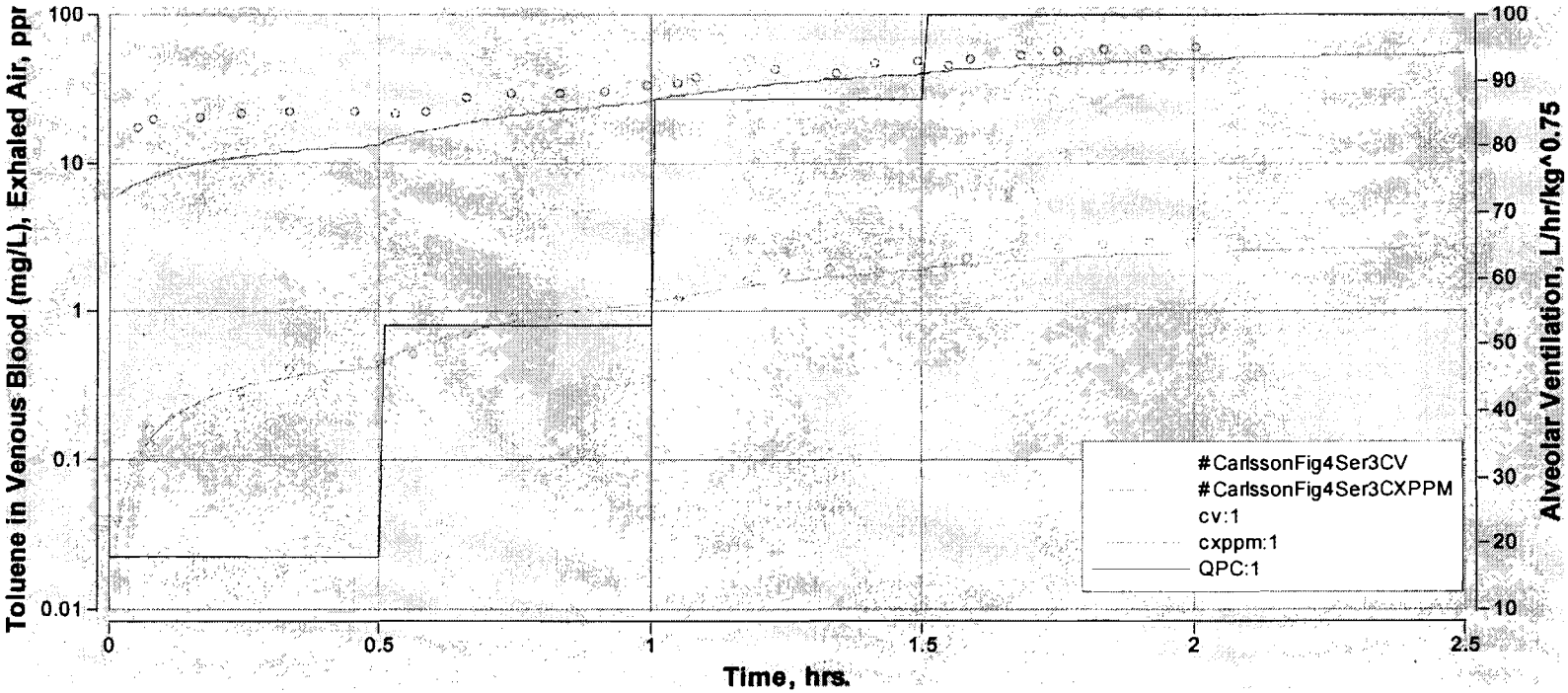


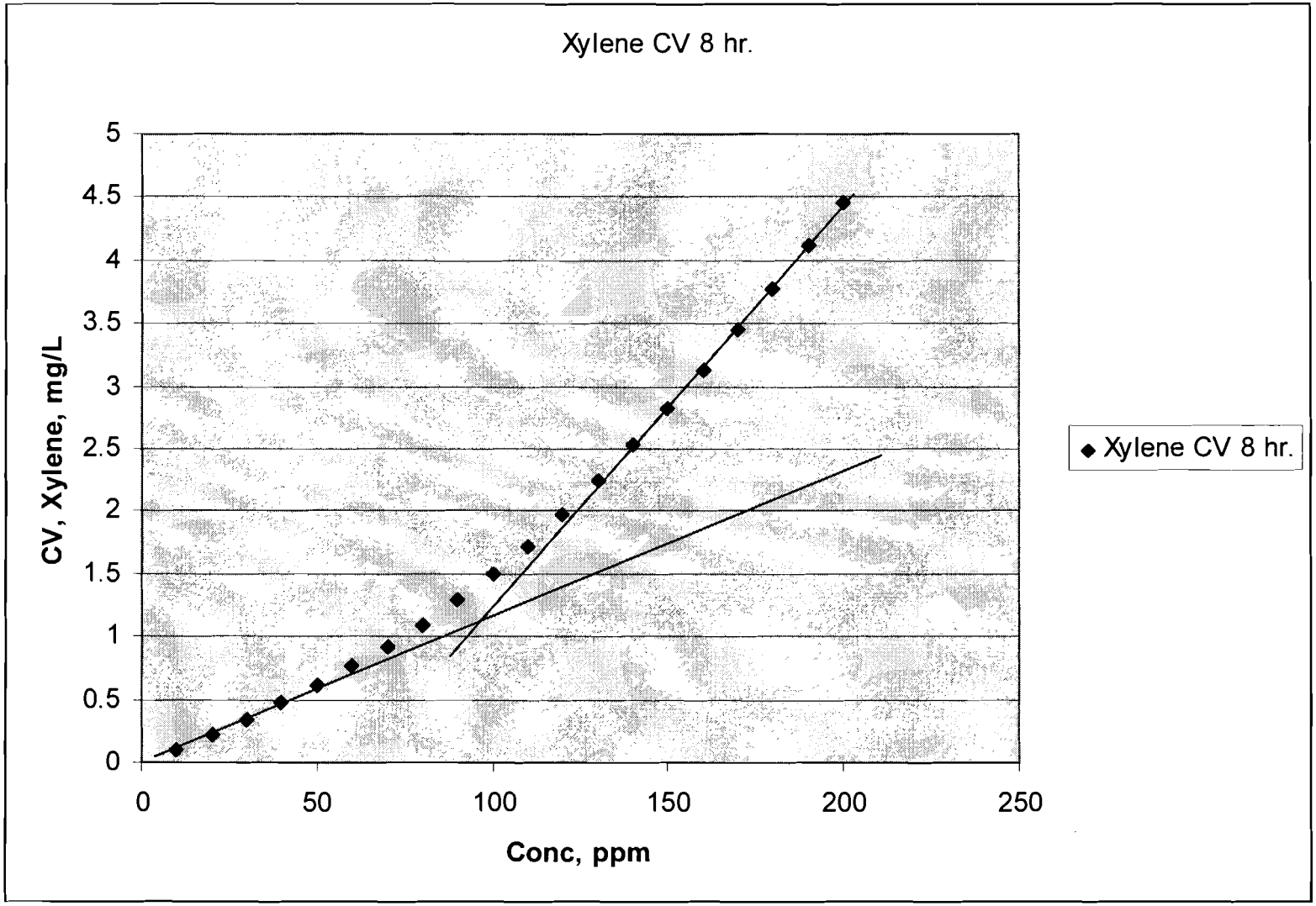
Duration	10 m	30 m	1 hr	4 hr	8 hr
Workload (Output)	200	193	183	120	35
	150	145	137	93	35
	125	121	116	81	35
	100	97	93	68	35
	75	73	71	55	35
	50	49	48	43	35





Case Study- Toluene




Xylene CV 8 hr.
CV, Xylene, mg/L
0
0.5
1
1.5
2
2.5
3
3.5
4
4.5
5
0
50
100
150
200
250
Conc, ppm
Xylene CV 8 hr.

ATTACHMENT 5

Acute Exposure Guideline Levels Revised Chemical Priority List

Paul S. Tobin, Ph.D.

Marquea D. King, Ph.D.

U.S. Environmental Protection Agency

NAC/AEGL - Meeting 36

Research Triangle Park, NC

April 12, 2005

Current Sources Identifying Priority AEGL Chemicals

Priority List 1 – 85 chemicals published (5/21/97 Federal Register)
Priority List 2 – 371 chemicals published (5/31/02 Federal Register)

ORGANIZATION LISTS USED FOR THE SELECTION OF PRIORITY CHEMICALS

ATSDR Agency for Toxic Substances and Disease Registry (36)
A = ATSDR "Top 20" Toxicology Profile Chemicals (6)
B = Medical Management Guide Chemical (7)
C = Chemicals with an ATSDR Toxicology Profile (33)

DOD Department of Defense (77)
A = Chemical Weapons Convention Schedule 1, 2, or 3 (2)
B = Strategic Environmental Research and Development Program (SERDP) Chemical (7)
C = Air Force Installation Restoration Program Chemical (10)
D = Army Toxicity Summary Chemical (9)
E = Non-Stockpile Chemical Warfare Substance (4)

Current Sources Identifying Priority AEGL Chemicals

DOE Department of Energy Subcommittee for Consequence Assessment SCAPA and Protective Action (80)
A = TEEL chemical with vapor pressure >3.2 mm (35)
B = TEEL chemical with TEEL-3 <25 ppm (9)
C = Lab List (9)
E = Other TEEL chemicals (39)

DOJ Department of Justice Office of Justice Programs (23)
A = "High" concern Toxic Industrial Material (TIM) (3)
B = "Medium" concern TIM (19)
C = "Low" concern TIM (10)

DOT Department of Transportation Emergency Response Guidebook (201)

OSHA Occupational Safety and Health Administration
A = OSHA Process Safety Management Chemical (96)

Current Sources Identifying Priority AEGL Chemicals

EPA Environmental Protection Agency (95)
A = Environmental Protection Agency Clean Air Act 112r (Risk Management Program) (10)
B = CAAA 112b Chemical (Hazardous Air Pollutant) (40)
B* = April 1, 1994 list submitted by OAQPS (HAP with current acute toxicity interest) (9)
C = Environmental Protection Agency Superfund Chemical (24)
D = EPA Extremely Hazardous Substance List (* = EHS solid with RTECS LC data) (8)
E = CAAA 112r Risk Management Program (77)
F = Office of Pesticides Nomination (28)
G = National Homeland Security Research Center (NHSRC) (?)
H = High Production Volume (HPV)

ERPG Emergency Response Planning Guideline (American Industrial Hygiene Association)
A = ERPG (87)

Other International
State
Local
Organizations

Provisions for Chemical Priority List Modifications

...“the “working list,” is subject to modification if priorities of the NAC/AEGL Committee or individual stakeholder organizations, including international members, change during that period…”

(2001 Standing Operating Procedures for Developing Acute Exposure Guideline Levels for Hazardous Chemicals, pg. 166, Appendix A)

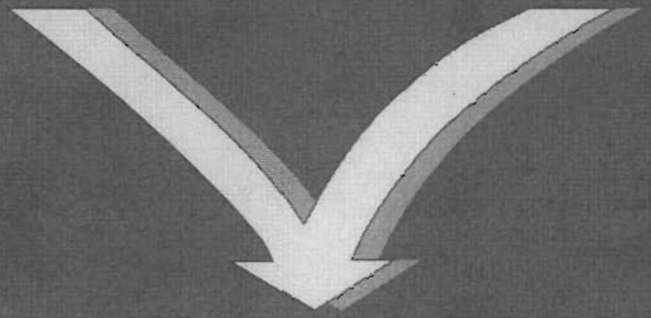
Strategies to Identify AEGL Priority Chemicals

Stakeholder Sources

- RMP chemicals (77)
- DOT Emergency Response Guidebook Isolation Table (201)
- OSHA Chemical Process Safety Chemicals (135)
- SEVESO II Treaty Chemicals (23)

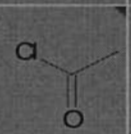
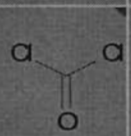
Common Chemical Criteria

- Criteria based
  - Toxicity
  - Vapor pressure
  - Structure/physical state
  - Production volume
  - Frequency/exposure potential



2005 Revised AEGL Chemical Priority List

AEGL Chemical Priority List Structure
(arranged by Chemical Class)

CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG
Acid Halides													
 O=C(Cl)C	75-36-5	acetyl chloride					l/52 700mm		x-W			HPV	
 O=C(Cl)Cl	75-44-5	phosgene	1F	0.75	0.30	NR	g	x	x	x	x	RMP/ Y	x

320 chemicals in 46 classes

Advantages to Using AEGL Chemical Priority List

- Grouping chemicals for review/AEGL development
  - Toxic endpoints, pharmacokinetics, pharmacodynamics
  - Develop values for chemicals with sparse datasets
  - Guidance ranges for protective equipment (respirators)
  - Establish detection ranges for chemical classes

Advantages to Using AEGL Chemical Priority List

- Increase awareness and appreciation
  - Number of chemicals that different organizations are concerned about
  - Help in harmonizing organizations' efforts in chemical emergency programs
  - Fact sheets
  - Identify testing needs
  - Influence stakeholder lists (regulatory & non-regulatory)

- Current chemicals in commerce [100,000]
  - 70,000 TSCA Inventory*

  *Inorganics NOT in TSCA Inventory Update Rule (TSCA IUR)

  *Production reporting over 10,000 lbs only for organics; inorganics reporting in 2006 (results available 2007).

  - 30,000 PMN

Dissemination Strategy

- Concurrence & Outreach

1. April NAC meeting – comments
2. Additional Stakeholder feedback
3. Federal Register Notice
4. Present to societies, organizations, interest groups
5. Press Release

Legend for AEGL Chemical Priority List (March 15, 2005)

CHEMISTRY (structures)
note: structures do not show properly, because they were designed in Accord Software for Excel and do not move with edits to the table.

CasNo.
Chemical Cas Registry Number.

ChemName
The common chemical name.

List
Original chemical list/current AEGL chemical status. For example, 1F = Chemical Priority List One, Status = Final
Status codes:F = Final; I = Interim; P = Proposed; H = Holding; pl = Planning

AEGL-3 1 Hr
The AEGL 3 value for a one hour exposure.

AEGL-2 1 Hr
The AEGL 2 value for a one hour exposure.

AEGL-1 1 Hr
The AEGL 1 value for a one hour exposure.
*These values has been arbitrarily selected for comparison from one chemical to another.

Physical State: s l (bp, vp) g
The physical state for a chemical:
s = solid; l = liquid (followed by boiling point and vapor pressure); g = gas

RMP
Indication 'x' if a chemical is listed on the EPA Clean Air Act and Amendments Risk Management Program (CAAA s. 112r) list for focus on prevention of industrial accidents that could harm community populations.

DOT
(a) Indication 'x' if a chemical is listed in the Department of Transportation Emergency Response Guidebook (ERG) Table of Initial Isolation and Protective Action Distances; 'x-W' reveals that the chemical is included at least in part due to release of toxic gas upon spill into water. All 201/201DOT Response Guidebook (ERG) Table of Initial Isolation and Protective Action Distances are included.
(b) Indication '0' if a chemical is listed in the DOT ERG but not in the Table of Initial Isolation and Protective Action Distances (the chemical did not meet specified qualification for vapor pressure to volatility ratio to make it onto this table, but did meet minimum qualification to make

it into the ERG).

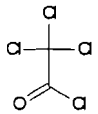
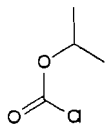
OSHA PSM
Indication 'x' that a chemical is listed in the OSHA Chemical Process Safety Table for focus on prevention of accidents in the workplace that could harm workers. 96/135 OSHA PSM chemcials appear on the AEGL Chemical Priority List. Some chemicals are listed on the OSHA PSM list for hazards other than toxicity, such as reactivity or explosivity and some listings are mixtures of toxic chemicals.

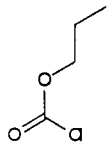
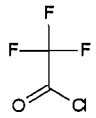
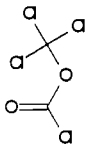
S II
Seveso II chemicals are a subset of chemicals from a Seveso I listing, list II was developed shortly after the Bohpal incident in 1984, for chemicals which met certain criteria.

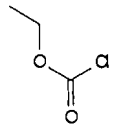
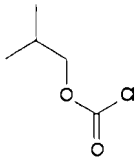
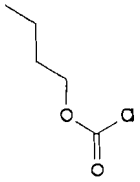
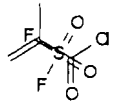
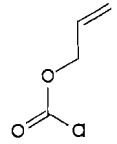
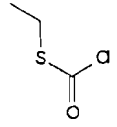
Prod
(a) Indication of 'HPV" (High Production Volume, over 1 million lbs) chemical.
(b) Indication of 'RMP/Y' Risk Management Program chemical with at least one reporting facility.
(c) Indication of 'RMP/N' Risk Risk Management Program chemical without at least one reporting facility.
(d) Indication 'T a----b' of TSCA Inventory production information for 2002 (or a previous reporting year as indicated).
(e) Unfortunately, TSCA Inventory Update Rule (IUR) information on inorganics will not be available until about 2007-2008 and OPPT/EETD is helping us with production information on some of these chemicals.
(f) For some chemicals, a separate search in chemical handbooks and google indicates some qualitative opinion about "significant" production and is indicated by "yes" or "no" in parentheses: (Y = Indication of significant production; Y? = Possible indication of significant production; N? = Unlikely indication of significant production; N = Indication of no significant production).
(g) For some chemicals, like chemicals with use only as chemical weapons, but of interest for AEGL development, production is indicated as "N/A" = Not assigned.

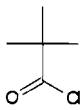
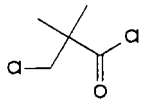
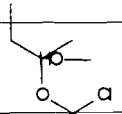
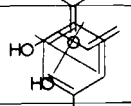
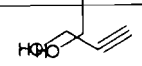
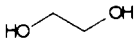
ERPG
Notation that a chemical has been reviewed by the American Industrial Hygiene Association "Emergency Response Planning Guideline" Committee and values have been published. 87/111 ERPG chemcials appear on the AEGL Chemical Priority List.

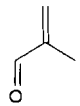
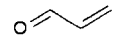
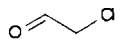
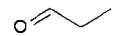
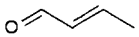
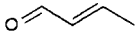
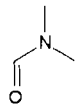
IDLH
Notation that a chemical has been reviewed by NIOSH and an Immediately Dangerous to Life or Health value has been published for use in respirator selection. 111/387 IDLH chemicals appear on the AEGL Chemical Priority List. Some chemicals, for example, are more of a concern for workplace exposure, such as certain chemical dusts.

CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
Acid Halides														
 O=C(Cl)C	75-36-5	acetyl chloride					l/52 700mm		x-W			HPV		
 O=C(Cl)Cl	75-44-5	phosgene	1F	0.75	0.30	NR	g	x	x	x	x	RMP/Y	x	
 O=C(C(Cl)(Cl)Cl)Cl	76-02-8	trichloroacetyl chloride	2H				l/114 16mm		x			T 10-500K		
 O=C(CCl)Cl	79-04-9	chloroacetyl chloride	2P	52	1.6	0.040	l/108 25mm		x-W			HPV	x	
 O=C(OC)Cl	79-22-1	methyl chloroformate	1H				l/70 248mm	x	x	x		RMP/Y		
	79-36-7	dichloroacetyl chloride	2P	52	1.6	0.040	l/107 23mm		0			T 1-10m		
 O=C(OC(C)C)Cl	108-23-6	isopropyl chloroformate	1H				l/105 50mm	x	x			RMP/Y	x	

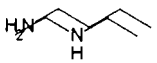
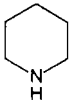
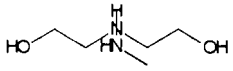
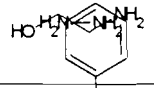
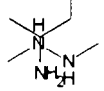
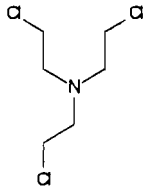
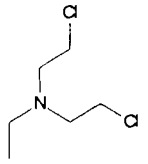
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 O=C(OCCC)Cl	109-61-5	propyl chloroformate	1H				l/105 45mm	x	x			RMP/Y		
 O=S(=O)(C)Cl	124-63-0	methanesulfonyl chloride	2				l/161 3.1mm		x			T 1-10M		
 O=C(F)F	353-50-4	carbonyl fluoride	2				g		x	x		(Y)		
 O=C(C(F)(F)F)Cl	354-32-5	trifluoroacetyl chloride	2				g		x			T 1-10M		
 S=C(Cl)Cl	463-71-8	thiophosgene	2				l/73 116mm		x			(N?)		
CH3COI	502-02-8	acetyl iodide	2				l/105 20mm		x-W					
 ClC(=O)OC(Cl)(Cl)Cl	503-38-8	diphosgene	2				l/128 10mm		x			(N?)		
 O=C(Br)C	509-96-7	acetyl bromide	2				l/77 122mm		x-W					

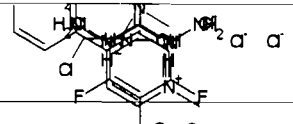
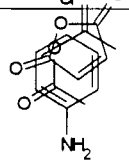
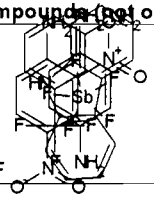
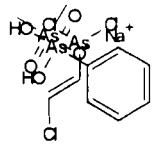
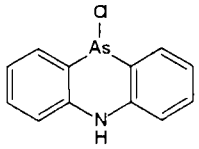
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 O=C(OCC)Cl	541-41-3	ethyl chloroformate	2				l/93 22mm		x			HPV		
 O=C(OCC(C)C)Cl	543-27-1	i-butyl chloroformate	2				l/129 8.4mm		x			T 1-10M		
 O=C(OCCCC)Cl	592-34-7	n-butyl chloroformate	2				l/142 8mm		x			(N?)		
 O=C(C=C)Cl	814-68-6	acrylyl chloride	1H				l/72 99mm	x		x		RMP/N		
 FS(F)(=O)=O	2699-79-8	sulfuryl fluoride	2				g		x					x
 O=C(OCC=C)Cl	2937-50-0	allyl chloroformate	2				l/110 20mm		x			T 10-500K		
 O=C(SCC)Cl	2941-64-2	ethylchlorothio formate	2				l/132 10mm		x			HPV		

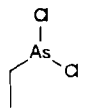
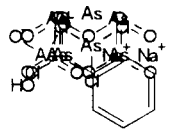
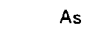
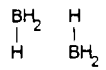
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 O=C(C(C)(C)C)Cl	3282-30-2	trimethylacetyl chloride	2				l/105 36mm		x			HPV		
 O=C(C(CCl)(C)C)Cl	4300-97-4	chloropivaloyl chloride	2				l/>200 <.1mm		x					
 O=S(Cl)Cl	7719-09-7	thionyl chloride	2				l/79 97mm		x	x		1986 T 10-500K i	x	
 OS(F)(=O)=O	7789-21-1	fluorosulfonic acid	2				l/166 2.5mm		x			(Y)		
 S(=O)(=O)(Cl)O	7790-94-5	chlorosulfonic acid	2				l/151 1mm		x				x	
Alcohols														
 OC	67-56-1	methanol	1l	7100	2100	530	l/65 98mm		0		x	HPV	x	x
 OCC=C	107-18-6	allyl alcohol	1l	67	4.2	2.1	l/96 24mm	x	x			RMP/Y		x
 OCC#C	107-19-7	propargyl alcohol	2				l/114 12mm		0			HPV		
 OCCO	107-21-1	ethylene glycol	2pl				l/196 0.06mm					HPV		
Aldehydes														
 O=C	50-00-0	formaldehyde	2P	56	14	0.90	g	x	0	x	x	RMP/Y	x	x

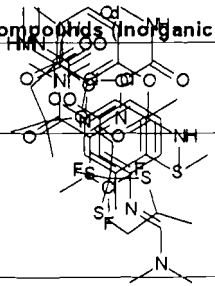
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 O=CC	75-07-0	acetaldehyde	2P	840	270	45	g		0	x		HPV	x	x
 O=CC(=C)C	78-85-3	methacryladehyde	2				l/68 155mm		0	x		T 1986 10-500K		
 O=CC=C	107-02-8	acrolein	1I	1.4	0.10	0.030	l/53 200mm	x	x	x		RMP/Y		x
 O=CCCl	107-20-0	chloroacetaldehyde	2P	9.9	2.2	1.3	l/85 64mm		x			T 1998 10-500K		x
 O=CCC	123-38-6	propionaldehyde	2P	840	260	45	l/48 317mm		0			HPV		
 O=CC=CC	123-73-9	(E-) crotonaldehyde	1I	14	4.4	0.19	l/104 32mm	x	x			RMP/Y	x	x
 O=CC=CC	4170-30-3	crotonaldehyde	1I	14	4.4	0.19	l/101 32mm	x	x			RMP/Y	x	x
Aluminum Compounds (not otherwise classified)														
 Cl[Al](Cl)Cl	7446-70-0	aluminum chloride	2				s		x-W			T 1994 10-500K		
AlBr3	7727-15-3	aluminum bromide	2				s		x-W					
Amides														
 O=CN(C)C	68-12-2	dimethylformamide	1I	180	90	NR	l/153 2.7mm		0			HPV	x	x

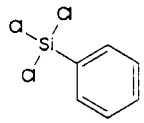
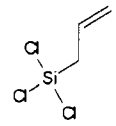
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
Magnesium diamide	7803-54-5	magnesium diamide	2				s		x-W					
Amines														
N-Mustard 2	51-75-2	nitrogen mustard-2	2pl				l/200d 0.43mm		x					
N(N)(C)C	57-14-7	1,1-dimethyl hydrazine	1F	11	3.0	NR	l/62 103mm	x	x	x		RMP/Y		x
N(N)C	60-34-4	methyl hydrazine	1F	2.7	0.90	NR	l/87 38mm	x	x	x		RMP/Y		x
NC	74-89-5	methyl amine	2pl				g		0	x		HPV	x	x
NCC	75-04-7	ethyl amine	2pl				g		0	x		HPV		x
N(C)(C)C	75-50-3	trimethyl amine	2pl				g		0			HPV	x	
NCC=C	107-11-9	allyl amine	1l	18	3.3	0.42	l/53 211mm	x	x	x		RMP/Y		
NCCN	107-15-3	ethylene diamine	1l	20	9.7	NR'	l/116 12mm	x	0			RMP/Y		x
NC(CCCC1)C1	108-91-8	cyclohexylamine	1l	30	8.6	1.8	l/134 10mm	x	0			RMP/Y		

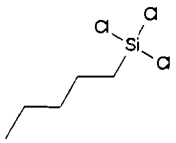
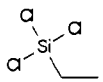
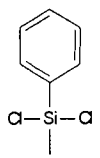
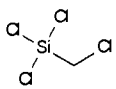
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 N(CC)CC	109-89-7	diethyl amine	2				l/56 237mm		0			HPV		x
 n(cccc1)c1	110-86-1	pyridine	2				l/116 21mm		0			HPV		x
 N(CCCC1)C1	110-89-4	piperidine	1P	110	33	6.6	l/106 23mm	x	0			HPV RMP/Y	x	
 N(C)C	124-40-3	dimethyl amine	2pl				g		0			HPV	x	x
	302-01-2	hydrazine	1l	35	13	0.10	l/114 10mm	x	0			RMP/Y	x	x
	540-73-8	1,2-dimethylhydrazine	1F	11	3.0	NR	l/81 70mm		x					
 ClCCN(CCCl)CCCl	555-77-1	N-Mustard-3: tris(2- chloro ethyl) amine	2pl				256 0.01mm		x			T 1998 10-500K (2000=0)		
 CCN(CCCl)CCCl	538-07-8	HN-1: bis(2-chloroethyl) ethylamine	2pl				l/194 0.25mm		x					
	6581-06-2	BZ	x				s		x					

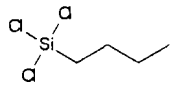
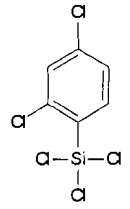
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 NO	7803-49-8	hydroxyl amine	2pl				l/110 53mm			x		(Y)		
Anilines														
 Nc(cccc1)c1	62-53-3	aniline	1F	20	12	8.0	l/184 0.7mm					HPV		x
Antimony Compounds (not otherwise classified)														
 F[Sb](F)(F)(F)F	7783-70-2	anitmony pentafluoride	2				l/141 7mm		x-W			(Y?)		
 [H][Sb]([H])[H]	7803-52-3	stibine	2				g		x	x			x	
Arsenic Compounds (not otherwise classified)														
 ClC=C[As](Cl)Cl	541-25-3	lewisite	2P	0.74	0.12	NR	l/190 0.4mm		x					
 Cl[As](Cl)C	593-89-5	methyldichloroarsine	2P	0.16	0.053	NR	l/133 8mm		x			(N)		
 Chemistry 2	578-94-9	adamsite	2P	6.4	2.6	0.016	s		x					

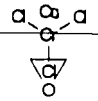
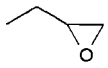
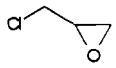
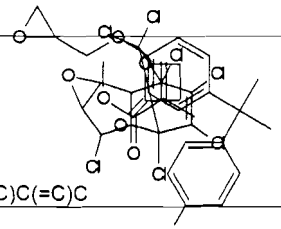
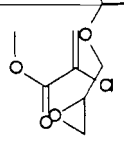
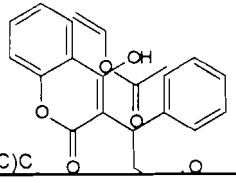
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 CC[As](Cl)Cl	598-14-1	ethyl dichloroarsine	2	0.086	0.029	NR	l/156 2.3mm		x			(N)		
As4O10	1303-28-2	arsenic pentoxide									x			
As4O6	1327-53-3	arsenic trioxide									x			
 [As](Cl)(Cl)Cl	7784-34-1	arsenic trichloride	1H				l/130 c.10mm	x	x			RMP/N		
 [As]	7784-42-1	arsine	1F	0.5	0.17	NR	g	x	x	x	x	RMP/Y	x	x
Boron Comounds (not otherwise classified)														
BF3 (CH3OCH3)	353-42-4	boron trifluoride methyl etherate	1T	14	3.1	0.12	g	x	x	x		RMP/Y	x	x
 BrB(Br)Br	10294-33-4	boron tribromide	2				l/91 63mm		x			(Y)		
 ClB(Cl)Cl	10294-34-5	boron trichloride	1T	28	7.3	0.60	g	x	x	x		RMP/Y		
B5H9 bridged	19624-22-7	pentaborane	2				l/58 170mm		x	x		(N?)		x
 H3B-BH3	19287-45-7	diborane	1F	3.7	1.0	NR	g	x	x	x		RMP/Y	x	x

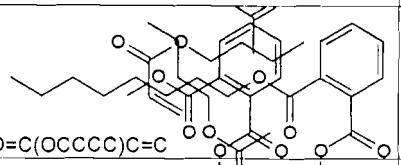
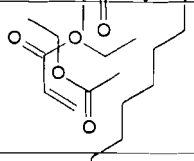
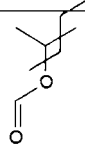
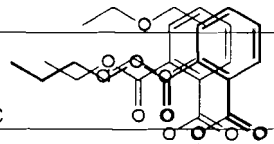
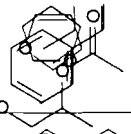
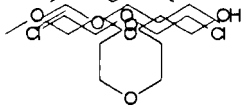
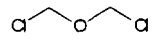
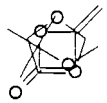
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S ll	Prod	ERPG	IDLH
Bromine Compounds (not otherwise classied)														
Br—Br BrBr	7726-95-6	bromine	1l	8.5	0.24	0.024	l/59 175mm	x	x	x	x	RMP/Y	x	x
 Br(F)(F)F	7787-71-5	bromine trifluoride	2P	21	2.0	0.12	g	x	x-W	x		RMP/Y		x
 FBr(F)(F)(F)F	7789-30-2	bromine pentafluoride	2P	33	1.0	NR	g		x-W	x		(N)		
Br—Cl BrCl	13863-41-7	bromine chloride	2				g		x	x		(Y?) T 1986 1-10M i		
Calcium compounds														
		calcium dithionite							x-W					
Chlorine Compounds (inorganic, not otherwise classified)														
 ClCl	7782-50-5	chlorine	1F	20	2.0	0.50	g	x	x	x	x	RMP/Y	x	x
Cl(F)(F)F	7790-91-2	chlorine trifluoride	1l	7.3	0.70	0.12	g		x	x			x	x
 [O.][Cl+][O-]	10049-04-4	chlorine dioxide	1l	2.4	1.1	0.15	g	x	x-W	x		RMP/Y	x	x
ClF5	13637-63-3	chlorine pentafluoride	2P	8	1.0	0.30	g		x	x		(N?)		
Chlorosilanes														
MeSiCl2H	75-54-7	methyl dichlorosilane	2				l/41 350mm		x-W			HPV		

CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 Cl[Si](C)(C)C	75-77-4	trimethyl chlorosilane	1P	130	32	1.8	l/58 150mm	x	x-W			RMP/Y	x	
 C[Si](C)(Cl)Cl	75-78-5	dimethyl dichlorosilane	1l	53	13	0.90	l/69 c.150mm	x	x-W	x		RMP/Y	x	
 C[Si](Cl)(Cl)Cl	75-79-6	methyl trichlorosilane	1l	28	6.2	0.60	l/66 150mm	x	x-W	x		RMP/Y	x	
	75-94-5	vinyl trichlorosilane	2				l/90 60mm		x-W			HPV		
	80-10-4	diphenyldichloro silane	2				l/305 2mm		x-W			T 10-500K		
	98-12-4	cyclohexyltrichloro silane	2				l/200 2mm		x-W			1-10M		
 Cl[Si](Cl)(Cl)c1ccccc1	98-13-5	trichlorophenyl silane	2				l/202 0.43mm		x-W			HPV		
 ClSi(Cl)(Cl)CC=C	107-37-9	allyl trichlorosilane	2				l/117 18mm		x-W			(N?) T 1994 <10K		

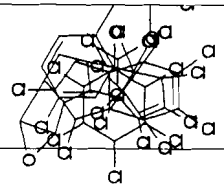
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 CCCCC[Si](Cl)(Cl)Cl	107-72-2	amyltrichlorosilane	2				l/171 3.5mm		x-W			T 1998 10-500K		
	112-04-9	octadecyltrichloro silane							x-W			1994 10-500K		
 CC[Si](Cl)(Cl)Cl	115-21-9	trichloroethyl silane	2				l/99 c.30mm		x-W			HPV		
	141-57-1	propyltrichlorosilane	2				l/c.125 c.15mm		x-W			T 10-500K		
 Cl[Si](c1ccccc1)(Cl)C	149-74-6	dichloromethyl phenyl silane	2				l/205 0.4mm		x-W			HPV		
	928-65-4	hexyltrichlorosilane	2				l/c.200 c.2mm		x-W			T 10-500K		
 Cl[Si](Cl)(Cl)CCl	1558-25-4	chloromethyl trichloro silane	2				l/118 30mm		x-W	x		(N?)		

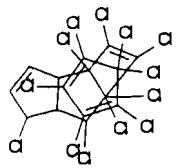
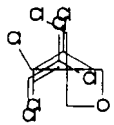
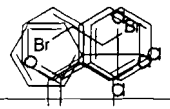
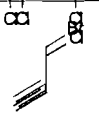
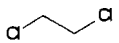
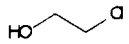
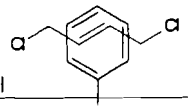
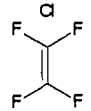
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
	1719-53-5	diethyl dichlorosilane							x-W					
 Cl[Si]Cl	4109-96-0	dichlorosilane	2				g		x-W	x		(Y) T 1986 <10K		
	4484-72-4	dodecyltrichloro silane	2				l/>200 <0.1mm		x-W					
	5283-67-0	nonyltrichloro silane	2				l/>200 <0.1mm		x-W					
	5283-66-9	octyltrichloro silane	2				l/>200 <0.1mm		x-W			T 1-10M		
 Cl[Si](Cl)(Cl)CCCC	7521-80-4	butyl trichlorosilane	2				l/149 c.4mm		x-W			(N?)		
	10025-78-2	trichlorosilane	2				l/31 500mm		x-W	x		T 1-10M	x	
 Cl[Si](c1c(cc(cc1)Cl)Cl)(Cl)Cl	27137-85-5	trichloro(dichlorophenyl) silane	2				l/260 <0.1mm		x-W	x				
CH3SiClH2	993-00-0	methyl chlorosilane	2				g		x-W			(Y?)		
Chromium compounds														
	14977-61-8	chromium oxychloride							x-W					

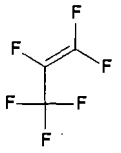
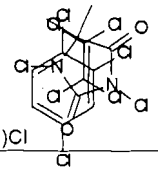
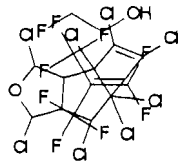
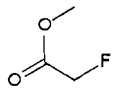
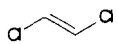
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
Epoxides 														
O(C1)C1	75-21-8	ethylene oxide	1I	200	45	NR	g	x	x	x	x	RMP/Y	x	x
O(C1C)C1 	75-56-9	propylene oxide	1I	870	290	73	l/34 400mm	x	0		x	RMP/Y	x	x
O(C1CC)C1 	106-88-7	1,2-butylene oxide	2				l/63 180mm		0			HPV		
O(C1CCl)C1 	106-89-8	epichlorohydrin	1P	72	24	6.8	l/115 14mm	x				RMP/Y	x	x
	371-62-0	ethylene fluorohydrin	2				l/104 21mm			x		(N)		
Esters														
O=C(OC)C(=C)C 	80-62-6	methyl methacrylate	2P	500	120	17	l/101 39mm		0			HPV		x
O=C(OC)C(=C)Cl 	80-63-7	methyl 2-chloroacrylate	2H				l/140 29mm					(N)		
O=C(OC=C)C 	108-05-4	vinyl acetate monomer	2pl	610	180	6.7	l/73 90mm	x	0			HPV RMP/Y	x	

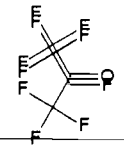
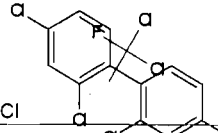
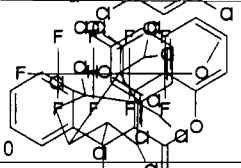
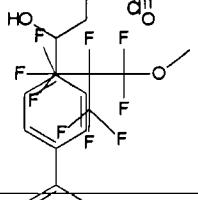
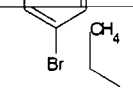
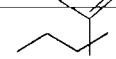
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S ll	Prod	ERPG	IDLH
 O=C(OCCCC)C=C	141-32-2	butyl acrylate	2P	480	130	8.3	l/145 5.5mm		0			HPV	x	
 O=C(OCC)C=C	140-88-5	ethyl acrylate	2P	240	36	8.3	l/100 39mm		0			HPV	x	x
 O=C(OC1=C)C1	674-82-8	diketene	2pl				l/127 11mm		x			HPV	x	
Ethers														
 O(CCl)C	107-30-2	chloromethyl methyl ether	1l	0.94	0.061	NA	l/55 180mm	x	x	x	x	RMP/Y	x	
 O1C=CC=C1	110-00-9	furan	1	29	10	NA	l/32 500mm	x	0			RMP/Y		
 O(CCOC1)C1	123-91-1	1,4-dioxane	1l	760	320	17	l/100 40mm		0			T 1-10M		x
 O(CCl)CCl	542-88-1	bis-chloromethyl ether	2				l/104 30mm	x		x	x	RMP/N	x	
 O(C(C)(C)C)C	1634-04-4	methyl t-butyl ether	2pl				l/55 250mm		0			HPV		
	1746-01-6	2,3,7,8-tetrachloro-p-dioxin									x			

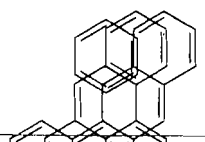
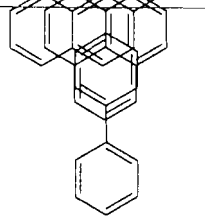
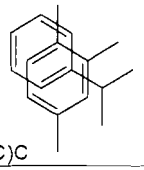
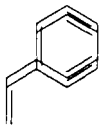
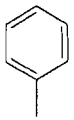
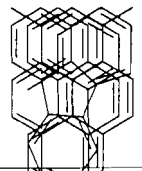
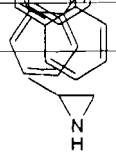
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
	136677-10-6	chloro dibenzofurans									x			
Fluorine Compounds (not otherwise classified)														
IF5	7183-66-6	iodine pentafluoride	2				g		x-W					
Cl(F)(=O)(=O)=O	7616-94-6	perchloryl fluoride	2				g		x			(N?)		x
FF	7782-41-4	fluorine	1I	13	5.0	1.7	g	x	x	x	x	RMP/Y	x	x
FOF	7783-41-7	oxygen difluoride	2				g		x	x		(N?)		x
	7783-60-0	sulfur tetrafluoride	2				g	x	x			RMP/Y		
F[U](F)(F)(F)(F)F	7783-81-5	uranium hexafluoride	1F	36	9.6	3.6	g		x			(Y)	x	
Germanium Compounds (not otherwise classified)														
[H][Ge]([H])([H])[H]	7782-65-2	germane	2				g		x			(Y) T 1986 <10K I		
Halogens														
C(Cl)(Cl)(Cl)Cl	56-23-5	carbon tetrachloride	1I	170	56	12	I/76 91mm		0			T 100-500M	x	x

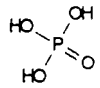
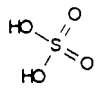
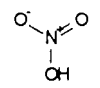
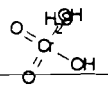
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 C(Cl)(Cl)Cl	67-66-3	chloroform	1P	1700	64	NR	l/61 160mm	x	0			RMP/Y	x	x
See CAS # 25323-89-1	71-55-6	1,1,1-trichloroethane	1I	4200	600	230	l/74 100mm		x			HPV	x	
BrC	74-83-9	methyl bromide	2P	740	210	NR	g		x	x		HPV	x	x
ClC	74-87-3	methyl chloride	2P	3000	910	NR	g	x		x		RMP/Y	x	x
 CI	74-88-4	methyl iodide	2				l/43 405mm		x	x		T 10-500K	x	x
 C(=C)Cl	75-01-4	vinyl chloride	2P	4800	1200	250	g		0			HPV	x	
 FC=C	75-02-5	vinyl fluoride	2				g		0			HPV		
 ClCCl	75-09-2	methylene chloride	1P	6900	560	200	l/40 350mm		0			HPV	x	x
 BrC(Br)Br	75-25-2	bromoform	2				l/146 5mm		0			T 1998 10-500K		x
 C(Cl)(Cl)C	75-34-3	1,1-dichloroethane	2				l/c.83 c.87mm		0			HPV		x

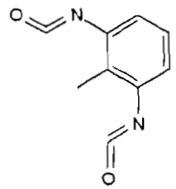
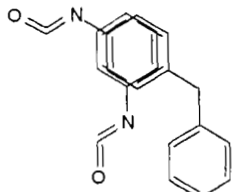
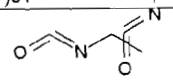
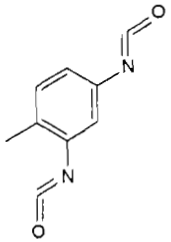
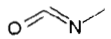
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 C(=C(C(=C1Cl)Cl)Cl)(C1(Cl)Cl)Cl	77-47-4	hexachlorocyclopentadiene	2				l/239 0.6mm		x			HPV		
 C(=CCl)(Cl)Cl	79-01-6	trichloroethylene	1P	3800	450	130	g		0			HPV	x	x
 FC(F)=C(F)Cl	79-38-9	trifluorochloro ethylene	2				g		x	x		HPV	x	
 BrCCBr	106-93-4	dibromoethane	2P	26	NR	NR	l/131 11mm		x			HPV		x
 C(=C)CCl	107-05-1	allyl chloride	2				l/44 280mm		0	x		HPV	x	x
 ClCCCl	107-06-2	1,2-dichloroethane	2				l/83 87mm					HPV	x	
 OCCCl	107-07-3	chloroethanol	2				l/130 15mm		x			500K-1M		x
 C(=CCCl)CCl	110-57-6	trans-1,4-dichlorobutene	2				l/156 6mm		0			HPV		
 FC(F)=C(F)F	116-14-3	tetrafluoroethylene	2				g		0	x		HPV	x	

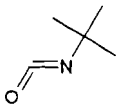
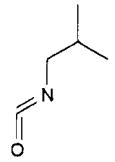
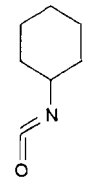
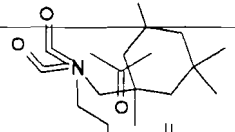
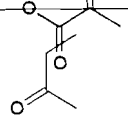
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 FC(F)(F)C(F)=C(F)F	116-15-4	hexafluoropropylene	2				g		0			HPV	x	
 C(=C(Cl)Cl)(Cl)Cl	127-18-4	tetrachloroethylene	1l	1200	230	35	l/121 13mm		0			HPV	x	x
cis ClCH=CHCl	156-59-2	cis-1,2-dichloroethylene	1l	850	500	140	l/81 215mm		0			T 1994 10-500K		x
trans ClCH=CHCl	156-60-5	trans-1,2-dichloroethylene	1l	1700	1000	280	l/50 340mm		0					x
 FC(F)=C(C(F)(F)F)C(F)(F)F	382-21-8	perfluoroisobutylene	2				g		0			(Y?)		
 O=C(OC)CF	453-18-9	methyl fluoroacetate	2				l/105 c.20mm					(N?)		
 C(=CCl)Cl	540-59-0	1,2-dichloroethylene	1				l/c.80 c.200mm		0			T 500K-1M		x
 FC	593-53-3	methyl fluoride	2				g		0			(Y?)		

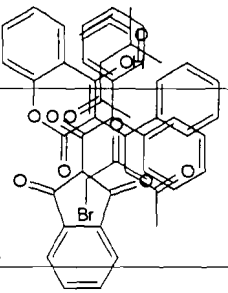
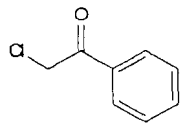
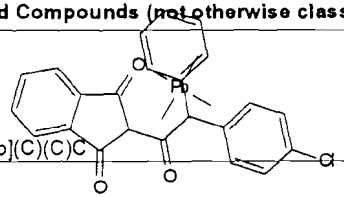
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 FCC(F)(F)F	811-97-2	HFC 134a (1,1,1,2-tetrafluoroethane)	1F	27000	13000	8000	g		x			HPV		
 CC(F)(Cl)Cl	1717-00-6	HCFC 141b (1,1-dichloro-1-fluoroethane)	1F	3000	1700	1000	g					HPV		
 Chemistry 0	163702-07-6	HFE 7100 (methyl nonafluorobutyl ether)	1I	15000	8200	2500	g					T 500K-1M		
 Chemistry 1	163702-08-7	HFE 7100 (methyl nonafluoroisobutyl ether)	1I	15000	8200	2500	g					T 1M-10M		
Hydrocarbons (Aliphatic)														
 C(C)C	74-98-6	propane	2P	33,000	17000	5,500	g		0			HPV	x	x
 C(C=C)=C	106-99-0	butadiene	2P	22,000	5300	670	g		0			HPV	x	x
 C(CC)C	106-97-8	butane	2P	53,000	17000	5,500	g		0			HPV	x	
 C(CCCC)C	110-54-3	hexane	2P	8,600	3300	NR	l/69 151mm		0			HPV	x	x
	115-07-1	propylene	2pl				g		0			HPV	x	
 CH	8006-61-9	gasoline	2				l		0			HPV	x	
 CH	70892-10-3	jet fuels 8	1I	NA	1100	290	l		0			(Y)	x	

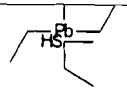
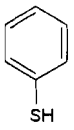
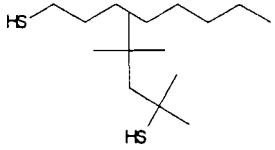
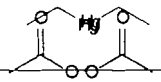
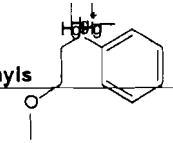
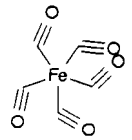
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
Hydrocarbons (Aromatic)														
 c(cccc1)c1	71-43-2	benzene	1P	4000	800	52	l/80 75mm		0			HPV	x	x
 c(c(cccc1)c1)(cccc2)c2	92-52-4	biphenyl	2P	NR	9.6	NR	l/256 0.0005mm					HPV		x
 c(cccc1)(c1)C(C)C	98-82-8	cumene	2P	730	300	50	l/152 4.5mm		0			HPV		x
 c(cccc1)(c1)C=C	100-42-5	styrene	2P	1100	130	20	l/145 6.4mm		0			HPV	x	x
 c(cccc1)(c1)C	108-88-3	toluene	1I	2900	510	200	l/110 26mm		0			HPV	x	x
 Cc1ccccc1C	1330-20-7	xylenes	1I	1100	400	130	l/140 15mm		0			HPV		x
Imines														
 N(C1C)C1	75-55-8	propyleneimine	1I	23	12	NR	l/66 112mm	x	0			RMP/Y		x

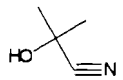
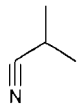
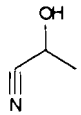
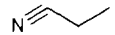
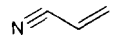
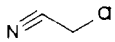
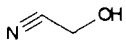
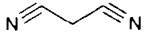
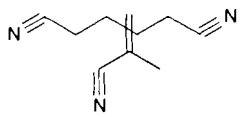
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 N(C1)C1	151-56-4	ethyleneimine	1l	9.9	4.6	NR	l/56 160mm	x	x	x	x	RMP/Y		x
Inorganic Acids														
 Cl	7647-01-0	hydrogen chloride gas	1F	100	22	1.8	g	x	x	x	x	RMP/Y	x	x
HCl	7647-01-0	hydrochloric acid (solution)	1F	100	22	1.8	solution		x	x		HPV/Y		x
 OP(O)(O)=O	7664-38-2	phosphoric acid	2				l/260 <<0.1mm		0			HPV		x
 F	7664-39-3	hydrogen fluoride	1F	44	24	1.0	g	x	x	x		RMP/Y	x	x
 OS(O)(=O)=O	7664-93-9	sulfuric acid	1P	160	9	0.20	l/290 <<0.1mm		x			>1B	x	x
 O[N+]([O-])=O	7697-37-2	nitric acid	1l	92	24	0.53	l/121 8mm	x	x	x		RMP/Y	x	x
 S	7783-06-4	hydrogen sulfide	2l	50	27	0.51	g	x	x	x		RMP/Y	x	x
 [Se]	7783-07-5	hydrogen selenide	2P	2.2	0.73	NR	g	x	x	x		RMP/Y	x	x
 I	10034-85-2	hydrogen iodide	2P	120	22	1.0	g		x					
 Br	10035-10-6	hydrogen bromide	2P	120	22	1.0	g		x	x		T 1994 10-500K		x
Isocyanates														

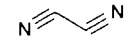
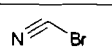
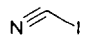
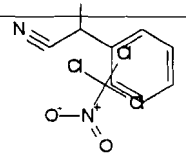
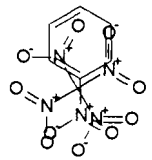
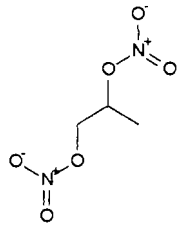
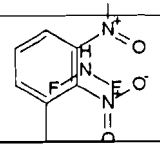
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 O=C=Nc(c(c(N=C=O)cc1)C)c1	91-08-7	toluene 2,6-diisocyanate (2,6-TDI)	1F	0.51	0.083	0.020hh	l/132 3.2mm	x	0		x	RMP/Y	x	
 O=C=Nc(cccc1)c1	103-71-9	phenyl isocyanate	2				l/165 2.6mm		x			T 10-500K		
 O=C=NCC	109-90-0	ethyl isocyanate	2				l/60 220mm		x			(N?)		
 O=C=NCCC	110-78-1	n-propyl isocyanate	2				l/83 c.50mm		x			T 1986 10-500K		
 O=C=NCCCC	111-36-4	n-butyl isocyanate	2				l/115 18mm		x			HPV	x	
 O=C=Nc(c(ccc1N=C=O)C)c1	584-84-9	toluene 2,4-diisocyanate (2,4-TDI)	1F	0.51	0.083	0.020	l/251 0.01mm	x	0		x	RMP/Y		x
 O=C=NC	624-83-9	methyl isocyanate	1F	0.20	0.067	NR	l/39 400mm	x	x	x	x	RMP/Y	x	x

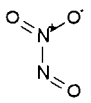
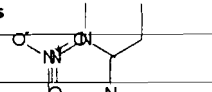
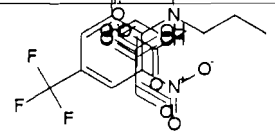
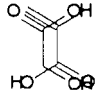
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 O=C=NC(C)(C)C	1609-86-5	t-butyl isocyanate	2				l/85 c.50mm		x			(N)		
	1795-48-8	isopropyl isocyanate	2				l/74 c.50mm		x					
 O=C=NCC(C)C	1873-29-6	isobutyl isocyanate	2				l/c.80 c.50mm		x			(N)		
 O=C=NC(CCCC1)C1	3173-53-3	cyclohexyl isocyanate	2pl				l/69 1mm		x			HPV		
	6427-21-0	methoxymethyl isocyanate	2				l/c.100 c.20mm		x			(N)		
Ketones														
 O=C(C)C	67-64-1	acetone	2P	5700	3200	200	l/56 230mm		0			HPV		x
 O=C(CC)C	78-93-3	methyl ethyl ketone (2-butanone; MEK)	1I	4000	2700	200	l/80 91mm		0			HPV		x
 O=C(C=C)C	78-94-4	methyl vinyl ketone	2P				l/81 152mm		x	x		(N?) T 1986 10-500K		

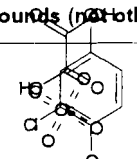
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S ll	Prod	ERPG	IDLH
 O=C(CCl)C	78-95-5	chloroacetone	2P	13	4.4	NR	l/119 12mm		x			HPV		
C=C=O	463-51-4	ketene	2				g			x		(Y)		x
 BrCC(=O)C	598-31-2	bromoacetone	2				l/137 9mm		x			(N)		
	684-16-2	hexafluoroacetone	2pl				g		x	x		T 10-500K	x	
 ClCC(=O)c1ccccc1	1341-24-8	chloroacetophenone	2pl				l/225 0.0076mm		0					x
Lead Compounds (not otherwise classified)														
 C[Pb](C)(C)C	75-74-1	tetramethyl lead	1H				l/110 c.20mm	x				RMP/N		x
Lithium compounds														
	26134-62-3	lithium nitride							x-W					
Mercaptans														

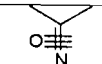
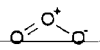
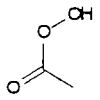
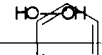
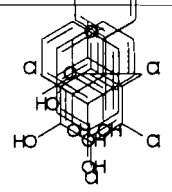
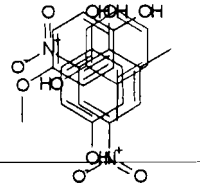
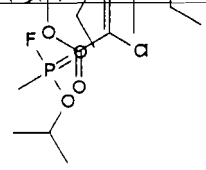
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 SC	74-93-1	methyl mercaptan	1l	68	47	NR	g	x	x	x		RMP/Y	x	x
 SCC	75-08-1	ethyl mercaptan	2P	360	120	1.0	l/82 89mm		0			HPV		x
 Sc(cccc1)c1	108-98-5	phenyl mercaptan	2				l/169 1mm		x			HPV		
 SC(CC(C)(C)C)(C)C	141-59-3	t-octyl mercaptan	2				l/c,200 <0.01mm		x					
Mercury Compounds (not otherwise classified)														
 [Hg]	7439-97-6	mercury	2pl				s 0.002mm		0			T 1990 10-500K	x	x
 **Metal Carbonyls**														
Ni (CO)4	13463-39-3	nickel carbonyl	1l	0.16	0.036	NR	l/43 400mm	x	x	x		RMP/Y		x
 [Fe](C#[O:])(C#[O:])(C#[O:])(C#[O:])(C#[O:])	13463-40-6	iron pentacarbonyl	1l	0.60	0.20	NR	l/103 35mm	x	x	x		RMP/Y		
Nitriles N														
 N#C	74-90-8	hydrogen cyanide	1F	15	7.1	2.0	g	x	x	x		RMP/Y	x	x
N#CC	75-05-8	acetonitrile	2P	490	230	13	l/82 89mm		0			HPV		x

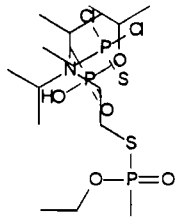
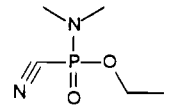
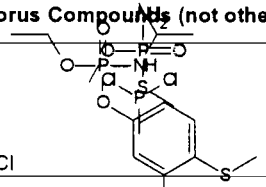
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 N#CC(O)(C)C	75-86-5	acetone cyanohydrin	1l	15	7.1	2.0	l/decompose 1mm		x			HPV		
 N#CC(C)C	78-82-0	isobutyronitrile	1l	68	18	NR	l/107 c.20mm	x	0			RMP/Y	x	
	100-47-0	benzonitrile	2P	56	22	NR	l/191 <0.1mm		0			T 500K-1M		
 N#CCC	107-12-0	propionitrile	1l	37	7.0	NR	l/98 40mm	x	0			RMP/Y		
 N#CC=C	107-13-1	acrylonitrile	2pl				l/77 109mm	x	0			HPV RMP/Y	x	x
 N#CCCl	107-14-2	chloroacetonitrile	2P	49	23	NR	l/125 15mm		x			(Y?)	x	
 N#CCO	107-16-4	formaldehyde cyanohydrin	2				l/183 0.02mm					HPV		
 N#CCC#N	109-77-3	malononitrile	2P	7.5	3.5	NR	l/220 0.08mm		0			T 10-500K		
 N#CC(=C)C	126-98-7	methacrylonitrile	1l	25	13	1.0	l/90 60mm	x	x	x		RMP/Y		
 [Na+].[C-]#N	143-33-9	sodium cyanide	2				s 0.002mm		x-W			T 10-50M		x

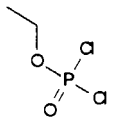
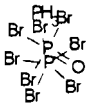
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
	151-50-8	potassium cyanide	2				s 0.002mm		x-W			T 1998 10-500K		x
 N#CC#N	460-19-5	cyanogen	2				g		x	x		(N?)		
	506-77-4	cyanogen chloride	1H				g	x	x	x		RMP/N	x	
	2698-41-1	o-chlorobenzylidene malononitrile	2				l/310 <0.01mm		x			T 1990 10-500K		x
Nitro Compounds														
 O=[N+]([O-])C(Cl)(Cl)Cl	76-06-2	chloropicrin	2				l/112 c.20mm		x	x		(Y)	x	x
 O=[N+]([O-])C([N+]([O-])=O)([N+]([O-])=O)[N	509-14-8	tetranitromethane	1I	1.7	0.52	NR	l/126 8.4mm	x	x	x		RMP/N		x
 O=[N+]([O-])OCC(O[N+]([O-])=O)C	6423-43-4	Otto Fuel (Propylene glycol dinitrate)	1F	13	1.0	0.17	l/decompose 0.088mm					HPV		
Nitrogen Compounds (not otherwise classified)														
 FN(F)	1341-49-7	ammonium fluoride	2				g					T 500K-1M		

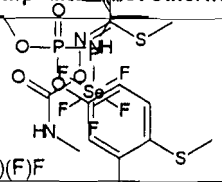
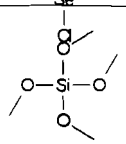
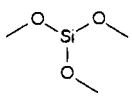
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 ClN=O	2696-92-6	nitrosyl chloride	2				g		x			(Y)		
 N(	7664-41-7	ammonia	1l	1100	110	30	g	x	x	x		RMP/Y	x	x
 FN(F)F	7783-54-2	nitrogen trifluoride	2				g			x		(Y)		x
 N=O	10102-43-9	nitric oxide	1l	20	12	0.50	g	x	x	x		RMP/Y		x
 O=N=O	10102-44-0	nitrogen dioxide	1l	20	12	0.50	g		x	x			x	x
N2O4	10544-72-6	nitrogen tetroxide	2				g		x	x		(Y)		
 O=[N+]([O-])N=O	10544-73-7	nitrogen trioxide	2				g		x	x		(Y)		
Organic Acids														
	79-10-7	acrylic acid	1l	180	46	1.5	l/141 4mm		0			HPV	x	
 O=C(O)CCl	79-11-8	mono-chloroacetic acid	1l	NR	6.6	NR	s 0.002mm		0			HPV		
 O=C(O)C(=C)C	79-41-4	methacrylic acid	2				l/163 1mm		0			HPV		
Metal phosphides														

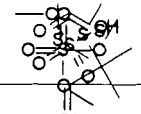
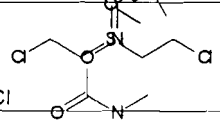
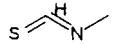
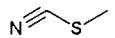
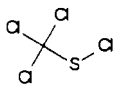
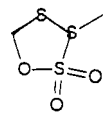
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
	1305-99-3	calcium phosphide	2				s		x-W					
	20770-41-6	Potassium phosphide	2				s		x-W					
	12057-74-8	magnesium phosphide	2				s		x-W					
	12058-85-4	sodium phosphide							x-W					
	12504-13-1	strontium phosphide	2				s		x-W					
	20859-73-8	aluminum phosphide	2				s		x-W					
	?	magnesium aluminum phosphide	2				s		x-W					
Osmium Compounds (not otherwise classified)														
 O=[Os](=O)(=O)=O	20816-12-0	osmium tetroxide	2				s		0	x				x
Oxygen Compounds (not otherwise classified)														

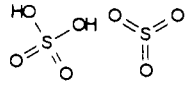
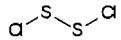
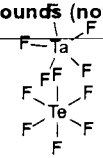
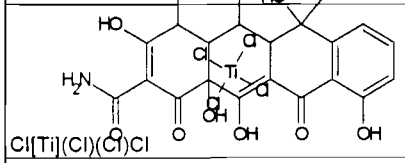
CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 O#C	630-08-0	carbon monoxide	2I	330	83	NR	g		x			HPV	x	x
Peroxides 														
 O=C(OO)C	79-21-0	peracetic acid	1I				l/105 15mm	x		x		RMP/Y		
Phenols 														
 Oc(cccc1)c1	108-95-2	phenol	1	47	15	4.5	s		0			HPV	x	x
 Oc1ccccc1C	1319-77-3	cresol	2						0			HPV		x
Phosphate & Thiophosphate Esters														
Phosphonate Esters  CC(OP(C)(F)=O)C(C)(C)C	96-64-0	Soman (GD)	1F	0.017	0.0022	0.00018	l/198 0.40mm		x			(NA)		
 CC(C)OP(C)(F)=O	107-44-8	Sarin (GB)	1F	0.022	0.0060	0.00048	l/158 2.1mm		x	x		(NA)		
	329-99-7	cyclohexylmethyl fluoridate (GF)	1F	0.018	0.0024	0.00022	l/239 0.044mm					(NA)		

CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 O=P(C)(OCC)SCCN(C(C)C)C(C)C	50782-69-9	VX	1	0.0030	0.000090	0.0000073	l/298 0.0007mm		x			(NA)		
 CCOP(=O)(C#N)N(C)C	77-81-6	Tabun (GA)	1	0.039	0.0053	0.00042	l/245 0.037mm		x			(NA)		
Phosphorus Compounds (not otherwise classified)														
 P(C)(Cl)Cl	676-83-5	methyl phosphonous dichloride	2				l/254 0.3mm		x					
 CP(Cl)(Cl)=O	676-97-1	methyl phosphonic dichloride	2				l/>200 <0.1mm		x					
CP(O)(O)=O	993-13-5	methyl phosphonic acid	2				l/>200 <0.1mm							
	993-43-1	ethyl phosphono thioic dichloride							x					
	1314-80-3	phosphorus pentasulfide	2				s		x			T 10-500K		x
Cl2P-CH2CH3	1498-40-4	ethylphosphonous dichloride	2				l/>200 <0.1mm		x			(N)		

CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 O=P(OCC)(Cl)Cl	1498-51-7	ethylphosphonodichloridate	2				l/>200 <0.1mm		x			HPV		
 P(F)(F)(F)(F)F	7647-19-0	phosphorus pentafluoride	2				g		x-W			(N)		
 ClP(Cl)Cl	7719-12-2	phosphorus trichloride	1	0.88	NA	NA	l/76 100mm	x	x	x		RMP/Y	x	x
 BrP(Br)(Br)(Br)Br	7789-69-7	phosphorus pentabromide	2				s		x-W					
 P	7803-51-2	phosphine	1l	3.6	2.0	NA	g	x	x	x		RMP/Y	x	x
 ClP(Cl)(Cl)=O	10025-87-3	phosphorus oxychloride	1l	0.85	NA	NA	l/106 40mm	x	x-W	x		RMP/Y		
 ClP(Cl)(Cl)(Cl)Cl	10026-13-8	phosphorus pentachloride	2				l/167 <1mm		x-W			1990 10-500K		x
Pyridines														

CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
	1737-93-5	3,5-dichloro-2,4,6-trifluoropyridine	2				l/160 <1mm		x			1-10M		
Selenium Compounds (not otherwise classified)														
 F[Se](F)(F)(F)(F)F	7783-79-1	selenium hexafluoride	2				g		x	x		(N?)		x
Silicon Compounds (not otherwise classified)														
 CO[Si](OC)(OC)OC	681-84-5	tetramethoxy silane (methyl orthosilicate)	2				l/121 c.10mm		x			HPV	x	
 CO[Si](OC)OC	2487-90-3	trimethoxysilane	2				l/84 76mm		x	x		HPV	x	
 [Si]	7803-62-5	silane	2				g		0			(Y) T 1986 <10K i		
 [Si](F)(F)(F)F	7783-61-1	silicon tetrafluoride	2				g		x-W			(Y) T 1986 <10K i		
	10026-04-7	silicon tetrachloride	2				l/58 >50mm		x-W			100-500K		
Sulfur Compounds (not otherwise classified)														
	72-78-1	dimethyl sulfate							x					

CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 C(=S)=S	75-15-0	carbon disulfide	2I	480	160	4.0	l/47 360mm	x	0			RMP/Y	x	x
 O=C=S	463-58-1	carbonyl sulfide	2				l/50 >100mm		x			1986 1-10M l	x	
 ClCCSCCCl	505-60-2	sulfur mustard	1F	0.32	0.020	0.010	l/215 0.1mm					(NA)		
 N(=C=S)C	556-61-6	methyl isothiocyanate	2				l/117 15mm		x			HPV		
 N#CSC	556-64-9	methyl thiocyanate	2H				l/130 20mm	x				RMP/Y		
 S(C(Cl)(Cl)Cl)Cl	594-42-3	perchloromethyl mercaptan	1I				l/c.148d c.5mm	x	x	x		RMP/Y		x
 O=S(=O)(OCC1)C1	1120-71-4	1,3-propane sultone	2				l/>200 <0.1mm					10-500K		
 O=S=O	7446-09-5	sulfur dioxide	1I				g	x	x	x		RMP/Y	x	x
 S(=O)(=O)=O	7446-11-9	sulfur trioxide	1P				g	x	x	x	x	RMP/Y	x	
	7775-14-6	sodium dithionite	2				s		x-W			1-10M		

CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 S(F)(F)(F)F	7783-60-0	sulfur tetrafluoride	1H				g	x	x	x		RMP/N		
 O=S(=O)(Cl)Cl	7791-25-5	sulfuryl chloride	2				l/69 140mm		x-W			(Y) T1986 500K-1M i		
 O=S(=O)(O)O.O=S(=O)(=O)	8014-95-7	oleum (fuming sulfuric acid)	1P	160	8.7	0.20	l/>200 <<0.1mm	x	x	x		RMP/Y	x	
 ClSSCl	10025-67-9	disulfur dichloride	2P	15	6.4	0.53	l/138 c.10mm		x-W			1994 1-10M		x
 ClSCl	10545-99-0	sulfur dichloride	2	3	FALSE	TRUE	l/c.100 c.10mm		x-W		x	(Y?) T 1994 10-500K		
	14989-32-3	disulfur dichloride	2				l/c.100 c.10mm		x-W			(N?)		
Tellurium Compounds (not otherwise classified)														
 [Te](F)(F)(F)(F)(F)F	7783-80-4	tellurium hexafluoride	2	2	FALSE	TRUE	g		x	x		(N)		x
Titanium Compounds (not otherwise classified)														
 Cl[Ti](Cl)(Cl)Cl	7550-45-0	titanium tetrachloride	2P	92	TRUE	TRUE	l/136 10mm	x	x-W			RMP/Y	x	
 [Ti](Cl)(Cl)Cl	7705-07-9	titanium chloride	2	3	FALSE	TRUE			x-W			1990 10-500K		
Tungsten Compounds (not otherwise classified)														

CHEMISTRY	CASNo	ChemName	List	AEGL-3 1 Hr	AEGL-2 1 Hr	AEGL-1 1 Hr	s l(bp,vp) g	RMP	DOT	OSHA PSM	S II	Prod	ERPG	IDLH
 {W}(F)(F)(F)(F)(F)F	7783-82-6	tungsten hexafluoride	2				g		x			(Y)		
Zinc Compounds														
Zinc Dithionite		zinc dithionite					s		x					

ATTACHMENT 6

DERIVATION OF AEGL-1 VALUES FOR EPICHLOROHYDRIN

RESPONSE TO FEDERAL REGISTER COMMENTS

KOWETHA DAVIDSON, ORNL STAFF SCIENTIST

RICHARD THOMAS, CHEMICAL MANAGER

NAC/AEGL MEETING, Research Triangle Park, NC
April 12-14, 2005

AEGL-1 DERIVATION

- AEGL-1 values in the TSD were derived based on odor detection

- AEGL-1 derivation has to be revised, because these values are no longer based on odor detection

- Two proposal are presented

Summary of Effects of Exposure of Humans to Non-Lethal Concentrations of Epichlorohydrin			
Conc.	**Duration of Exposure**	**Effect**	**Reference**
10-12 ppm	5 min.	50% of subjects detected the odor	Shell Oil Co., 1992
10-20 ppm	work shift	cause irritation (not otherwise described)	Enterline et al. (1990)
17 ppm	2 min.	odor detected by 2/4 subjects, no irritation reported	UCC, 1983
25 ppm	5 min.	odor detection for 100% of subjects	Shell Oil Co., 1992
20 ppm	1 hour	burning of eyes and nasal mucosa	Wexler, 1971
40 ppm	1 hour	throat irritation that lasted 48 hours	Wexler, 1971
68 ppm	2 min.	odor detected for 4/4 subjects; 1/4 reported pharyngeal irritation	UCC, 1983
136 ppm	2 min.	2/4 subjects reported cooling sensation reported by; 2/4 subjects reported eye or pharyngeal irritation	UCC, 1983

PROPOSAL NO. 1

- Human study (UCC, 1983)
- Four subjects exposed to epichlorohydrin at concentrations of 17, 68, and 136 ppm for 2 minutes
- **17 ppm:** 2/4 subjects detected and identified odor of epichlorohydrin
- **68 ppm:** 4/4 subjects detected odor; 1/4 subjects reported irritation to the pharynx
- **136 ppm:** 2/4 subjects reported cooling sensation to eyes or mouth; 2/4 subjects reported irritation in the eyes or pharynx

Proposal No. 1 (cont.)

- Point of departure (POD): 68 ppm, 2 min.
- Uncertainty factors (UF):
  - Interspecies UF: NA
  - Intraspecies UF: 3 (irritant)
  - Scaling: $C^n \times t = k$, $n = 0.87$
  - AEGL-1 for 10 min = 3.6 ppm
  - No scaling to longer durations, epichlorohydrin is an irritant

AEGL-1 VALUES FOR EPICHLOROHYDRIN (ppm)				
10 min	**30 min**	**1 h**	**4 h**	**8 h**
3.6	3.6	3.6	3.6	3.6

PROPOSAL NO. 2

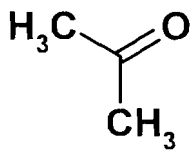
- Recommend no values for AEGL-1
- Rationale
  - Values derived under proposal no. 1 are below odor detection (OD_{50} = 10 ppm)
  - Values derived under proposal no. 1 are lower than 17 ppm where no irritation was detected (UCC, 1983)

Acute Exposure Guideline Levels (AEGLs)

for

Acetone

(CAS Reg. No. 67-64-1)



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Revisit of Acetone

SUMMARY TABLE OF AEGL VALUES FOR ACETONE [a]						
Classification	**10-Minute**	**30-Minute**	**1-Hour**	**4-Hour**	**8-Hour**	**Endpoint (Reference)**
AEGL-1 (Nondisabling)	200 ppm (470 mg/m³)	200 ppm (470 mg/m³)	200 ppm (470 mg/m³)	200 ppm (470 mg/m³)	200 ppm (470 mg/m³)	NOAEL for slight irritation (Ernstgard et al. 1999; Matsushita et al., 1969a; Nelson et al. 1943; Stewart et al. 1975)
AEGL-2 (Disabling)	9,300 ppm* (22,000 mg/m³)	4,900 ppm* (11,000 mg/m³)	3,200 ppm* (7700 mg/m³)	1,400 ppm (3400 mg/m³)	950 ppm (2300 mg/m³)	Ataxia in rats (Bruckner and Petersen 1981a; Goldberg et al. 1964)
AEGL-3 (Lethality)	see below #	8,600 ppm* (20,000 mg/m³)	5,700 ppm* (14,000 mg/m³)	2500 ppm (6000 mg/m³)	1,700 ppm (4000 mg/m³)	No lethality in rats (Bruckner and Petersen 1981a; Smyth et al. 1962)

a: Cutaneous absorption of liquid acetone may occur. Since liquid acetone is an eye irritant, eye contact must be avoided.

#: The lower explosive limit (LEL) of acetone in air is 2.6 % (26,000 ppm). The AEGL-3 value of 16,000 ppm (39,000 mg/m³) for 10 minutes is higher than 50 % of the LEL. Therefore, extreme safety considerations against hazard of explosion must be taken into account.

*: Concentrations are higher than 1/10 of the lower explosive limit of acetone in air. Therefore, safety considerations against hazard of explosion must be taken into account.

Comments made by

- **GAMA (Global Acetate Manufacturers´ Association, Brussels, Belgium), very detailed and complex comments; and by**
- **John Morawetz (ICWUC Center for Worker Health & Safety, Cincinnati, Ohio),**

GAMA: report "is very well written and reasonably detailed in many regards and .. most, but not all, of the critical studies described"; proposed limits are deficient in four areas:

1. **"AEGL-2 and AEGL-3 limits can be improved by establishing a human biological effect concentration that corresponds to the appearance of a particular neurological effect."**
   (GAMA considers approach using animal data "peculiar", instead, values not in accordance with observations at workplace, data from human case reports and PBPK model should be used)
2. **"AEGL-1 limits derived using outdated and unreliable information from unscientific symptom surveys."**
   (refer to new review of Arts et al., 2002)
3. **AEGL-1 limits do not conform with SOP for AEGL (use only sensory irritation as relevant endpoint, acetone is a very weak sensory irritant, AEGL-1 far too conservative)**
4. **AEGL-1 very close to LOA of 160 ppm, may result in unnecessary alarm or panic in an emergency situation.**
   (balance the need to keep people safe without causing widespread fear and confusion in the affected population)

5. **(errors or omissions in Table 8.2 regarding extant standards and guidelines for acetone; will be checked and corrected, but not be dealt further here)**

John Morawetz

- **Basis for AEGL-1: The "bottom line is that without any factor, the population variability stated in the SOP is not taken into account."**
  (do not use study of Nelson et al. (1943) since its use was rejected recently by NAC/AEGL in the derivation of AEGL for another substance (acetaldehyde).
  Remaining studies considered to have limitations because of the number of subjects were small, all were male and healthy.
  Therefore a modifying factor of 2 is recommended and 250 ppm be used as a starting point.
  This would lead to a (rounded) AEGL-1 of 130 ppm for all time points.
  Alternatively, John Morawetz also suggests to discuss that a higher concentration (with, however, effects above AEGL-1 threshold) and an intraspecies uncertainty factor of 3 might be used.

Statement to GAMA comments for AEGL-2 and -3

Case reports:

- **show that high blood levels (2500 mg/L) may be survived but these patients received intensive medical care at stationary hospital admittance, outcome otherwise not known**
- **sometimes biased by history of disease (chronic alcoholism) and medication**
- **uptake of mixtures, acetone not considered cause of death**
- **uptake of isopropanol, acetone is active metabolite but role of both hard to differentiate**

PBPK models:

- **may be useful to describe toxikokinetics at lower concentrations (about 500 ppm), but not validated at high exposure concentrations relevant for AEGL-2 and AEGL-3**
- **use of interspecies uncertainty factor would still be necessary to account for possible kinetic and, especially, toxikodynamic differences**

Recommendation:

Retain derived AEGL-2 and AEGL-3 values for all time points.

AEGL-1

- **GAMA states that AEGL-1 rely on "sensory irritation" which is observed for acetone at concentrations far higher than 1,000 ppm**
- **Statement to GAMA comments**
  - **Definition for AEGL-1:**

    "airborne concentration ... above which it is predicted that the general population, including susceptible individuals, could experience notable discomfort, irritation, or certain asymptomatic nonsensory effects. ... effects... not disabling...transient and reversible...."

    Not restricted to "objective" sensory irritation as suggested by GAMA, other factors also relevant.

    NRC (2001), derivation of SMAC ("Spacecraft Maximum Allowance Concentrations for Selected Airborne Chemicals"):

    - **"For 1-h and 24-h SMACs, a slight degree of adverse effects is acceptable as long as the effects do not limit an astronaut´s ability to perform during an emergency. The slight adverse effects at 200 ppm reported by Stewart et al. (1975) and those at 250 ppm reported by Matsushita et al. (1969a) are acceptable for short-term exposures (24 h), and, on the basis of the 1000-ppm results in the Stewart study, and the 500-ppm results in the Matsushita study, a 1-h exposure at 500 ppm should not affect performance."**
    - **Follow NRC (2001), but consider different protection level and group (trained astronaut´s**

ability vs. general public exposed without warning);

- AEGL-1 is in accordance with definition and fully consistent with NRC-evaluation in the derivation of SMACs.

- GAMA: AEGL-1 of 200 ppm close to LOA of 160 ppm, suggests widespread panic and mass confusion could develop in an emergency situation when people are exposed at or near the AEGL-1 level.

- Statement to GAMA comments

  - Cognitive bias can influence perceived irritation and health symptoms from acetone exposure (more health symptoms in "negatively biased" experimental groups)

  - Reaction to Acetone does not depend on the level of the AEGL-1 but on the subjective signs that may be felt at exposure. In an emergency situation, it is to be expected that persons exposed to acetone will react rather more than a "negatively" biased group.

  - Therefore, we consider an AEGL-1 level of 200 ppm as appropriate.

- **John Morawetz**
  - **without any factor, the population variability stated in the SOP is not taken into account. Use mofifying factor of 2.**
- **Statement to comment of J. Morawetz**
  - **Concentrations around 200 – 500 ppm represent the lowest level of the concentration range above which effects of exposure to acetone are increasingly reported. Although in the studies used all volunteers were males, not much variance is expected in the outcome between males and females with respect to the endpoints considered relevant here. Therefore, we suggest that a modifying factor is not necessary.**
- **Recommendation:**

  Retain derived AEGL-1 values for all time points.

Revisit of Acetone

AEGL-1

Key studies: Ernstgard et al. 1999; Matsushita et al. 1969a; Nelson et al. 1943; Stewart et al.1975

Endpoint: **200 ppm**: subjective symptoms (irritation) not reported more often than in controls (Nelson et al., 1943; Stewart et al.1975);

250 ppm: slight irritation, few complaints about discomfort in one study (Matsushita et al. 1969a) but not in another (Ernstgard et al. 1999)

300 ppm: slight irritation in majority of volunteers (Nelson et al. 1969);

Scaling: one value for all time points since local effect, accommodation, complaints about discomfort not reported to increase during several hours of exposure

Total uncertainty factor: 1

Intraspecies: 1

200 ppm as NOEL for local effects, effects weak at higher conentrations

AEGL-1 Values				
10 minutes	30 minutes	1 hour	4 hours	8 hours
200 ppm (470 mg/m^3)	200 ppm (470 mg/m^3)	200 ppm (470 mg/m^3)	200 ppm (470 mg/m^3)	200 ppm (470 mg/m^3)

Remark: AEGL-1 is above odor recognition threshold.

AEGL-2

Key studies: Goldberg et al. (1964);
Bruckner and Peterson 1981a

Endpoint: Effects on CNS in rats

LOAEL: 12000 ppm, 4 h;
12600 ppm, 3 h
(ataxia, reduced escape response)

NOEL: 6000 ppm, 4h

Scaling: $C^n \times t = k$, with n = 3 for shorter time periods and n = 1 for longer time periods (default).

Total uncertainty factor: 4.2

Interspecies: 1; because data do not indicate much variability in toxikokinetics and in acute neurotoxic effects between species;

factor of 3 incompatible with human data
(total UF = 10 would give
4-h AEGL-2: 600 ppm; 8-h AEGL-2: 300 ppm)

Intraspecies: 4.2; based on span of LD_{50} in rats of different age

AEGL-2 Values				
10 minutes	30 minutes	1 hour	4 hours	8 hours
9300 ppm* (22,000 mg/m³)	4000 ppm* (11,000 mg/m³)	3200 ppm* (7500 mg/m³)	1400 ppm (3400 mg/m³)	950 ppm (2300 mg/m³)

*: Values higher than 1/10 of lower explosive limit in air (2.6 %).

AEGL-3

Key studies: Smyth et al. (1962):
Death in 1/6 animals following exposure to 16,000 ppm 4 hours

Bruckner and Peterson 1981a:
No lethality in rats following exposure to 12,600 ppm for 3 hours

Endpoint: No lethality in rats at 12,600 ppm, 3 hours

Scaling: $C^n \times t = k$ with n=3 for shorter periods of time and n=1 for longer periods of time

Total uncertainty factor: 3

Interspecies: 1 (see AEGL-2);
factor of 3 incompatible with human data
(total UF = 10 would give
4-h AEGL-3: 950 ppm; 8-h AEGL-2: 470 ppm)

Intraspecies: 4.2

Because the threshold for acute neurotoxic effects on the CNS is not expected to vary much in humans

AEGL-3 Values Acetone				
10 minutes	30 minutes	1 hour	4 hours	8 hours
see below **	8600 ppm* (20,000 mg/m³)	3200 ppm* (7700 mg/m³)	1400 ppm* (3400 mg/m³)	950 ppm (2300 mg/m³)

*: Values higher than 1/10 of lower explosive limit in air (2.6 %); ** value higher than 50 % of LEL in air.

Level of Distinct Odor Awareness

LOA = 160 ppm

RESPONSE TO COT'S COMMENTS FOR ALLYL ALCOHOL

Claudia Troxel

Nancy Kim

Summary of proposed AEGL values for AllOH					
Level	**10-min**	**30-min**	**1-h**	**4-h**	**8-h**
AEGL-1	2.1	2.1	2.1	2.1	2.1
AEGL-2	4.2	4.2	4.2	4.2	4.2
AEGL-3	130	130	67	17	8.3

AEGL-1: Slight to moderate irritation in humans at 6.25 ppm for 5 minutes (Dunlap et al., 1958) [UF = 3]

AEGL-2: NOAEL for severe eye irritation in humans exposed at 12.5 ppm for 5 minutes (Dunlap et al., 1958) [UF = 3]

AEGL-3: Highest concentration w/ no mortality in mice, rats, and rabbits of 200 ppm for 1 h (Union Carbide, 1951) [UF = 3]

AEGL-3

- **n value**: derived value of 0.78 based on LC_{50} data from Dunlap et al., 1958; rounded to 1 to be consistent with other chemicals; the 10 min value was set equal to the 30-min value in order not to exceed the 150 ppm conc. that killed almost all the rats only two 7- or 8-hour exposures

- **COT:** NAC has had chemicals with n value of less than 1; rounding to 1 not in SOP

AEGL-3 Total UF of 3

Interspecies UF – 1 because the highest concentration causing no mortality was identical in all three species

Intraspecies UF - 3 because UF of 10 – inconsistent with data; 1, 4, and 8- hour would be 20, 5.1, and 2.5 ppm, respectively.

- Dunlap - rats: 7 hr/d, 5 days/wk for 60 exp. No effects at 1, 2, or 5 ppm; ↓ bw gain at 20 ppm.
- Torkelson - rats, guinea pigs, rabbits, and dogs: no effects at 2 ppm for 7 hr/d, 5 d/wk for 28 exp., reversible liver and kidney damage at 7 ppm for 7 hr/d, 5 d/wk for 134 exp.

COT: AEGL-3 Total UF of 3

- **Interspecies UF – 1** not justified; insufficient data to conclude that all species (including humans) respond similarly to the effects resulting from exposure (suggest UF of 3)

- **Intraspecies UF - 3** It is illogical to make a scientific judgment about what the UF should be based on the data and available information, and if the end result values seem inconsistent with other values, go back and adjust the UFs. The UFs should remain the same and then, if there is a strong reason to change the resulting numbers, an adjustment should be made.

AEGL-3 Derivations						
n	**UF**	**10 m**	**30 m**	**1 h**	**4 h**	**8 h**
1	3	400	130	67	17	8.3
1	10	120	40	20	5	2.5
1	30	40	13	6.7	1.7	0.83
0.8	3	620	160	67	12	5
0.8	10	190	48	20	3.5	1.5
0.8	30	62	16	6.7	1.2	0.5
AEGL-1		**2.1**	**2.1**	**2.1**	**2.1**	**2.1**
AEGL-2		**4.2**	**4.2**	**4.2**	**4.2**	**4.2**

COT COMMENTS FOR ALLYL ALCOHOL

Two main issues: selection of UF and value of n

Selection of UF of AEGL-3:

The NAC used an interspecies UF of 1 in deriving an AEGL-3 based on data from an animal study. The rationale provided for this determination is that "these data suggest little difference between species in response to allyl alcohol exposure" (page vii, line 28; page 17, lines 25-26). However, no data are provided in the Executive Summary to support this claim. The text (page 17, Section 4.3 Species) discusses some data, but it is not sufficient to conclude that all species (including humans) respond similarly to the effects resulting from exposure to allyl alcohol.

The data discussed in Section 4.3 are mostly lethality data, and no data on humans were presented that are comparable to the animal data. In addition, the text states that "the lethality data summarized in Table 5 lack LC_{50} values suitable for direct comparisons of species sensitivity" (page 17, lines 19-20). In addition, the data presented on nonlethal effects come from a study in which all the animal data were grouped together such that the reader cannot determine which specific effects occurred in which specific species. The text states that these results were "discussed in general terms for all species" (page 9, line 33). For these reasons, selecting an interspecies UF of 1 for AEGL-3 may not be justified, and a UF of 3 could be used to derive AEGL-3.

The argument for selecting an intraspecies UF of 3 for AEGL-3 is weak and not scientifically based; the values would be "inconsistent with available empirical data" (page vii, line 33). Inconsistency between the results and other established values is not sufficient reason to alter the UFs. It is illogical to make a scientific judgment about what the UF should be based on the data and available information, and if the end result values seem inconsistent with other values, go back and adjust the UFs. The UFs should remain the same and then, if there is a strong reason to change the resulting numbers, an adjustment should be made. There needs to be a solid scientific basis for moving away from the default value of 10. This should not be done in order to "make the numbers work."

Value of n for AEGL-3:

As written, it is not clear why the experimentally derived n = 0.8 in Section 4.4 was not used for time scaling since page 94 of the SOP lists TCE as one example of a substance with n = 0.8. There is nothing in Section 2.7 of the SOP that states empirical n values < 1.0 shall be assumed equal to the default n value of 1; SOP page 103 states, "The lowest value of n was 0.8 and the highest value of n was 3.5." Therefore, additional justification for n = 1 (page 20, lines 28-29) is needed unless the empirical n = 0.8 is used in time scaling.

EXECUTIVE SUMMARY

Allyl alcohol is a colorless liquid that is a potent sensory irritant. Signs of intoxication following inhalation exposure to allyl alcohol vapor include lacrimation, pulmonary edema and congestion, and inflammation, hemorrhage, and degeneration of the liver and kidney. Human data were limited to voluntary exposures for short durations and general statements about the symptoms following accidental occupational exposures to unknown concentrations of allyl alcohol for unspecified amounts of time. Animal data were limited to studies in which lethality was the only endpoint of interest, subchronic exposures, or single-exposure experiments in which the model was questionable.

The basis for derivation of AEGL-1 values was human data that reported exposure to 6.25 ppm allyl alcohol for 5 minutes resulted in slight or moderate nose irritation in 3/6 or 1/6 volunteers, respectively (Dunlap et al., 1958). An intraspecies uncertainty factor of 3 was used because irritation is not likely to vary greatly among individuals. The same 2.1 ppm value was applied across the 10- and 30-minute, and 1-, 4-, and 8-hour exposure times because mild irritancy generally does not vary greatly over time, and prolonged exposure is not expected to result in an enhanced effect.

The basis for derivation of AEGL-2 values was the human data from Dunlap et al. (1958). At 12.5 ppm for 5 minutes, moderate or greater nose irritation was reported in 4 of 7 volunteers, and 1/7 reported slight eye irritation. At 25 ppm for 5 minutes, severe eye irritation and moderate nose irritation were reported in 5/5 subjects. The 12.5 ppm was taken as a no-effect-level for severe eye irritation. An intraspecies uncertainty factor of 3 was applied based on the steep dose-response curve for eye irritation in humans (only one individual reported slight eye irritation at 6.25 or 12.5 ppm for 5 minutes, while all 5 individuals reported severe eye irritation at 25.0 ppm for 5 minutes). The same 4.2 ppm value was applied across the 10- and 30-minute, and 1-, 4-, and 8-hour exposure times because mild irritancy generally does not vary greatly over time, and because it is not expected that prolonged exposure will result in an enhanced effect.

The highest concentration causing no mortality in mice, rats, and rabbits of 200 ppm for 1 hour was chosen as the AEGL-3 endpoint (Union Carbide, 1951). The highest concentration causing no mortality was identical in all three species. At higher exposures each of these species had mortality. These data suggest little difference between species in response to allyl alcohol exposure. Therefore, the interspecies uncertainty factor was set to 1. An intraspecies uncertainty factor of 3 was chosen. Although the traditional approach for uncertainty factors in a case such as this would argue for an uncertainty factor of 10 because of the lack of data addressing inter-individual variability, this would result in a composite uncertainty factor of 10. An uncertainty factor of 10 would drive the AEGL-3 values to levels inconsistent with available empirical data. A total uncertainty factor of 10 would result in 1, 4, and 8- hour AEGL-3 values of 20, 5.1, and 2.5 ppm, respectively. Dunlap et al. (1958) reported that rats exposed for 7 hr/d, 5 days/wk for 60 exposures to 1, 2, or 5 ppm had no observable adverse effects, while rats exposed to 20 ppm only exhibited decreased body weight gain. Torkelson et al. (1959) reported that no adverse effects were noted when rats, guinea pigs, rabbits, and dogs were exposed to 2 ppm for 7 hr/d, 5

d/wk for 28 exposures, while exposure of rats, guinea pigs, and rabbits to 7 ppm for 7 hr/d, 5 d/wk for 134 exposures resulted only in reversible liver and kidney damage.

The experimentally derived exposure value was then scaled to AEGL time frames using the concentration-time relationship given by the equation $C^n \times t = k$, where C = concentration, t = time, k is a constant, and n generally ranges from 1 to 3.5 (ten Berge et al., 1986). To calculate n for allyl alcohol, a regression plot of the LC_{50} values was derived from the rat LC_{50} data (1-, 4-, and 8-hour LC_{50} values of 1060, 165, and 76 ppm, respectively) from Dunlap et al. (1958) The regression analysis resulted in an n value of 0.78. The NAC committee recommended using an n of 1 ($C^1 \times t = k$; Haber's Law) for consistency with other chemicals when an n of less than 1 is derived from the data.

The 10-minute AEGL-3 value was set equal to the 30-minute value. Repeated 7-hour and 8-hour exposures at 100 ppm required 32 or more days for all rats to die (Dunlap et al., 1958; Shell Chemical Corporation, 1957). At 150 ppm, however, all rats in one study (Shell Chemical Corporation, 1957), and 8 of 10 of the rats in the other study (Dunlap et al., 1958) died by the end of the first two exposures. In order not to exceed the 150 ppm concentration that killed almost all the animals in only two 7- or 8-hour exposures, the calculated 10-minute value of 400 ppm was set equal to the 30-minute value of 130 ppm.

The derived AEGL values are listed in the table.

SUMMARY OF AEGL VALUES FOR ALLYL ALCOHOL (ppm [mg/m^3])

Classification	10-min	30-min	1-hr	4-hr	8-hr	Endpoint (Reference)
AEGL-1 (Nondisabling)	2.1 [5.1]	2.1 [5.1]	2.1 [5.1]	2.1 [5.1]	2.1 [5.1]	Slight to moderate irritation in humans at 6.25 ppm for 5 minutes (Dunlap et al., 1958)
AEGL-2 (Disabling)	4.2 [10]	4.2 [10]	4.2 [10]	4.2 [10]	4.2 [10]	NOAEL for severe eye irritation in humans exposed at 12.5 ppm for 5 minutes (Dunlap et al., 1958)
AEGL-3 (Lethality)	130 [310]	130 [210]	67 [160]	17 [41]	8.3 [20]	Highest concentration causing no mortality in mice, rats, and rabbits of 200 ppm for 1 hr (Union Carbide, 1951)

References:

Dunlap, M.K., Kodama, J.K., Wellington, J.S., Anderson, H.H., and Hine, C.H. 1958. The toxicity of allyl alcohol. A.M.A. Arch. Ind. Health 18: 303-311.

Shell Chemical Corporation. 1957. Initial submission: Review of allyl alcohol toxicity with cover letter dated 10/15/92. Shell Chemical Corporation, New York, N.Y. Doc. # 88-920010558.

ten Berge, W.F., Zwart, A., and Appelman, L.M. 1986. Concentration-time mortality response relationship of irritant and systemically acting vapours and gases. J. Hazard. Mat. 13: 301-309.

Torkelson, T.R., Wolf, M.A., Oyen, F., and Rowe, V.K. 1959. Vapor toxicity of allyl alcohol as determined on laboratory animals. Am. Ind. Hyg. Assoc. J. 20: 224-229.

Union Carbide and Carbon Corporation. 1951. Initial submission: Letter from DuPont Chem to USEPA regarding a letter about toxicity studies with allyl alcohol with cover letter dated 10/15/92. Union Carbide and Carbon Corporation, New York, N.Y. Doc. # 88-920009857.