FINAL

ONE HUNDRED-AND-SEVENTY SEVENTH MEETING OF THE
NORTH CAROLINA SCIENCE ADVISORY BOARD ON TOXIC AIR POLLUTANTS (NCSAB)

Proceedings of the September 24, 2014 Webinar Conference

Dr. Starr called the meeting to order at 2:10 PM. NCSAB members Drs. Thomas Starr, Woodhall Stopford, and Elaina Kenyon were in attendance. Dr. Ivan Rusyn was travelling and joined the webinar for approximately the first 20 minutes. Dr. Dave Dorman was also travelling and joined the webinar at approximately 3:00 pm. Charles Carter, North Carolina Environmental Management Commission (EMC), Linda Culpepper, NCDENR Division of Waste Management, Mark Huncik, Environmental Consultant, Terese Vick, Blue Ridge Environmental Defense League, and Wes Younger, Smith Aldridge Inc., joined the webinar. Nancy Jones and Dr. Candace Prusiewicz, DAQ, were also in attendance.

Approval of August 2014 Minutes

Meeting minutes from the 175th NCSAB meeting held on August 6, 2014 were approved pending revisions to two editorial typos identified by Dr. Starr.

Meeting minutes that have been approved by the NCSAB are posted on the Division of Air Quality website at http://daq.state.nc.us/toxics/risk/sab/sab_minutes.shtml.

Discussion of 2015 NCSAB Meeting Schedule

The first agenda item discussed was the proposed NCSAB meeting dates for 2015. Traditionally, the board votes on the meeting schedule at the December meeting. The following dates were forwarded to board members in advance of the meeting for consideration.

January 28	July 29
April 1	September 30
May 27	December 2

NCSAB meetings are generally scheduled to begin at 2 pm. Dr. Dorman said that he will be teaching a class during the spring semester that will probably meet from 1:00 to 2:30 pm on Monday and Wednesday. He requested that the start time be changed to 3:00 pm during that period. Board members present agreed to the change for the January, April, and May meetings.

Review Strategy for Unique NC AALs

In advance of today's meeting, Dr. Prusiewicz had forwarded to board members an enhanced EXCEL spreadsheet summarizing key parameters requested by board members at the August 6th meeting. This spreadsheet was displayed during the webinar and is included as an Appendix at the end of these minutes.

Knowing that he was scheduled to be boarding a plane during the meeting and that he may not be able to fully participate, Dr. Rusyn called Dr. Prusiewicz shortly before the meeting and conveyed to her his thoughts about the spreadsheet and possible ways for the board to move forward with the binning of pollutants, He requested that she share his thoughts with the board in his absence. He offered the following suggestions:

Dr. Rusyn suggested that as a first cut, pollutants be grouped into bins based on their yearly emission quantities (from highest to lowest). Possible binning thresholds might be >1000 lbs, >10,000 lbs, >100,000 lbs or > 1 x 10^6 lbs (Column L). Dr. Rusyn thought that emission totals from the 97 NC counties regularly reporting to the DAQ could be used as the basis for this exercise as the emissions data from the three counties with local programs do not appear to be excessively large and do not appear to skew the emissions data (Column O).

Dr. Rusyn had noted that the uncertainty factors used in deriving the AALs (Column H) appear to be quite low and are atypical of current uncertainty factors. The basis for the uncertainty factors is a Decision Tree developed by the 1986 NC Academy of Sciences (Appendix 2). The Decision Tree shows an uncertainty factor of 10 was applied to most of the acute irritant STELs from that time.

Dr. Rusyn believed that most of the attention should be focused on highest production volume compounds. Very few of the ACGIH TLVs or STELs for this group of pollutants have changed since 1986 (Column K); hence these NC AALs are based on long-standing ACGIH values. Dr. Starr noted that the values in Column J (2013 ACGIH TLVs) were obtained from the 2013 ACGIH handbook and inquired if this meant that they had been recently reviewed. Dr. Prusiewicz responded that the values were the current published values; however this does not necessarily mean that they had been recently reviewed. The handbook only lists the current TLV/STEL values. It does not provide information about when the values were last reviewed/updated. Dr. Starr clarified that the ACGIH TLVs apply to the workplace.

Dr. Rusyn suggested that the board look more closely at the information in Column F (Critical Health Endpoint for AAL). He thought it was important to know the relevant human health endpoints and point of departure (POD) upon which the ACGIH values were based. This would enable the board to assess the validity of the current values. Dr. Prusiewicz pointed out that the one page NC AAL summaries (Document B from the 176th meeting) do not provide much detailed reference information on health endpoints. Thus, the 2013 ACGIH handbook was used to identify the human health endpoint upon which the AALs are based.

Dr. Stopford pointed out that ACGIH periodically publishes a compendium detailing the basis for each TLV, perhaps every five years; however it is quite expensive. He has an out of date compendium (2000 version) and believes that they may sell chemical specific documentation for about $30-40 each on-line. The 7th Edition was published in 2014 and costs approximately $795. Dr. Starr thought that it was important that the board have these materials for their evaluation. In this way, they would be better able to supplement the data included in the mega-spreadsheet with the specific studies supporting the identified human health endpoint. Dr. Prusiewicz agreed to follow up on acquiring the TLV basis documentation for each chemical on the list.

Dr. Rusyn had also suggested that if the pollutants were divided between board members at today's meeting, the data researched and gathered by each include URLs and search terms. He advised that each board member's findings be sent to the DAQ by early to mid-November for compilation before being forwarded to all members. In this way, members would have sufficient time to review the materials prior to the December meeting and be prepared to discuss them at the meeting

Dr. Rusyn had also recommended that no one person be assigned multiple compounds that have high emission volumes or substantial literature data sets to review. His intent was to divide the workload as evenly as possible amongst board members. Dr. Starr suggested that it might not be best to divide the list of pollutants by giving each member the same number of compounds. He observed that many of the pollutants produce acute respiratory and eye irritation effects associated with short term exposures (15 minutes to one hour). He thought it might be more efficient to group the compounds by health endpoint since the review would involve the same types of studies and the database would be relatively limited. Dr. Stopford noted he had published on some of the pollutants on the list. He thought that board members who had performed research on some of these chemicals might want to review the ones with which they were most familiar. Dr. Starr indicated that he had only been involved with toluene diisocyanate (TDI) because the NCSAB had looked at it not long ago. Dr. Stopford agreed that they were all familiar with that chemical. The board had evaluated TDI because of concerns about local population exposures from foam manufacturing facilities. Dr. Stopford said he had experience with five of the chemicals on the list. Dr. Starr noted that Dr. Dorman is an expert on hydrogen sulfide so he would be a good candidate to review that chemical. Dr. Kenyon said she had some experience with bromine, but didn't have a strong preference or a strong background in any of the chemicals. She volunteered to review the pollutants that no one else claimed.

Dr. Starr suggested the board look first at Column M (2012 emissions for 97 NC counties). He noted that the high volume chemicals were sulfuric acid (2.7 million pounds), ammonia (2.6 million pounds), hexane isomers (2.2 million pounds), and hydrogen sulfide (2.1 million pounds). He noted that the emission quantities of these pollutants were at least double the emission quantities of the other listed pollutants. Dr. Stopford noted that some of the chemicals listed in Column M are no longer emitted; thus he thought they could be ranked near the bottom of the list or excluded from consideration. These included 1,1,2,2-tetrachloro-1-2-difluoroethane (CFC-112), 1,1,1,2-tetrachloro-2,2-difluoroethane (CFC-112a) and 1,1,2-trichlorotrifluoroethane (CFC-113). Dr. Prusiewicz noted the *de minimus* values listed in Column N for these pollutants. Emissions less than the *de minimus* value are not required to be reported in North Carolina. Therefore, in instances where no emissions were reported to the inventory, it is possible that emissions still occurred (they may have occurred below the *de minimus* value). Dr. Stopford noted that these are CFCs that are banned and that may be why they are no longer released. Dr. Starr noted that the *de minimus* values for the CFCs ranged from 100-1000 pounds while the *de minimus* value for toluene diisocyanate (TDI) was one pound reflecting the relative toxicities of each. Board members agreed that the ban on CFCs was another reason to move these chemicals to the bottom of the list for consideration. Dr. Starr noted that CNS damage and liver impairment were associated with inhalation exposures to the CFCs. He asked Dr. Kenyon if she had any knowledge of these chemicals and she responded that PBPK models exist for these chemicals. She supported moving these compounds to the bottom of the list for consideration. Dr. Starr also supported this and said that in the absence of new emission sources, the emissions for these compounds will trend downwards with time.

Dr. Starr pointed out that dichlorodifluoromethane (CFC-12), another CFC, is associated with cardiac sensitization effects and is still being emitted in appreciable yearly amounts (13,688 pounds). Dr. Stopford mentioned he had researched and written about this pollutant and could take it on. He also pointed out that ethyl mercaptan is only released from landfills. He inquired about the procedure for setting an emissions limit for a landfill. He also asked how landfills are regulated and is this something that the SAB should be considering? Dr. Prusiewicz responded that landfills are permitted by the DAQ; hence they must adhere to the AALs. Dr. Stopford understood that landfills had to meet a different set of criteria than other sources. He recommended that ethyl mercaptan be moved to the bottom of the list because it is only emitted from landfills. Dr. Starr asked if Dr. Rusyn had expressed any preferences for chemicals that he was interested in researching. Dr. Prusiewicz responded that he had not.

Dr. Starr redirected the conversation back to the four high volume pollutants. He suggested assigning hydrogen sulfide to Dr. Dorman, unless he objected. He inquired about which manufacturing facilities would emit hexane isomers. He also asked if the ammonia emissions were from hog waste lagoons. Dr. Prusiewicz responded that hog waste lagoons were not considered point/stationary sources and emissions from the lagoons are not included in the total emission values. Dr. Starr suggested expanding the spreadsheet to include the types of facilities that emit each chemical.

Dr. Dorman joined the webinar at this point in time and Dr. Starr provided a brief summary of the meeting thus far. Dr. Starr summarized that the majority of compounds had long-standing AALs that were based on 1987 TLV values. Most of the compounds are eye/skin irritants, upper respiratory irritants, or induce CNS effects. Several of the AALs were extrapolated from 15 minute STELS and the majority of the uncertainty factors used had a value of ten. Dr. Dorman noted that for the vast majority of listed pollutants, the TLV values have not changed since 1987. This suggests that no new toxicological data exists for these compounds. He thought that the criteria of an unchanged TLV could be used as an additional means of ranking the pollutants. Dr. Stopford agreed and pointed out that total emission quantities had also been discussed as a potential ranking criterion.

Dr. Dorman clarified that the goal for the December meeting will be for the board to identify those AALs that will be revisited more formally. He asked how this determination will be made. Is the board planning to look at all the tox data and then make a determination? Dr. Stopford noted that others have performed comprehensive risk assessments on some of listed pollutants since the time the TLV approach was used to derive the North Carolina AALs. He recommended that the board look at work that has been done to see if others have come up with markedly different results compared with North Carolina's AALs. If they are markedly different, then the board should look at it again. Dr. Kenyon said that when she is handed a

chemical to evaluate, she first looks to see if any regulatory body or agency developing criteria values and undertaken a recent review. She relies on Toxicology Excellence for Risk Assessment (TERA), ATSDR, and EPA IRIS reviews. She also looks for recent review articles on these chemicals. Although Dr. Starr had originally thought that Dr. Dorman would review hydrogen sulfide, he reconsidered after noting that the board had evaluated hydrogen sulfide in 2006 (24-hour chronic AAL based on a 10-week rat inhalation study). He now believes that this chemical can be moved to the bottom of the list since it has been recently reviewed. Dr. Stopford agreed and noted that TDI falls into the same category. It was reviewed by the board in 2002 and can also be moved to the bottom of the list for consideration. The suggested pollutants were moved to the bottom of the list leaving fourteen chemicals for more thorough review by the board.

Dr. Dorman suggested that ethylenediamine could also be designated as a low priority due to its significant decrease in emissions (99% since 1997). In addition, its yearly emissions are less than 1,000 pounds per year. Dr. Stopford noted that in addition to being a sensitizer, ethylenediamine is fetotoxic and an irritant. Dr. Starr agreed that it should be moved to the bottom. Dr. Starr indicated that it would be important to look at the ACGIH documentation describing how the TLV was derived and how recently it had been reviewed. Dr. Stopford pointed out that the OSHA health guidelines for each chemical are free and readily available online. The OSHA guidelines show that the TLV for ethylenediamine was established in 1978. Dr. Prusiewicz said the DAQ would compile the OSHA data for these chemicals and get it to the board.

Dr. Starr suggested that since there were six members working on this project and the chemical list was reduced to fourteen, they could each take two or three. Dr. Dorman suggested grouping the chemicals by mode of action (for example – grouping acetic acid, nitric acid and sulfuric acid together). Dr. Starr said those causing systemic toxicity could also be grouped together. After further discussion, the chemicals, except those designated as low priority, were divided among the SAB members for further research as follows:

NCSAB Assignments for 21 Unique TAPs Review	
Dave Dorman	Acetic Acid (64-19-7) Nitric Acid (7697-37-2) Sulfuric Acid (7664-93-9)
Jane Hoppin	Dichlorodifluoromethane (CFC-12) (75-71-8) Dichlorofluoromethane (75-43-4) Trichlorofluoromethane (CFC-11) (75-69-4)
Elaina Kenyon	Hexane isomers, excluding n-hexane[1]
Ivan Rusyn	Ammonia (7664-41-7) Methyl Ethyl Ketone (78-93-3)
Tom Starr	Bromine (7726-95-6) Fluorides[2]
Sandy Stopford	Ethyl Acetate (141-78-6) Ethyl Mercaptan (75-08-1) Methyl Mercaptan (74-93-1)
Not assigned **(Considered low priority for AAL review)**	Ethylenediamine (107-15-3) Hydrogen Sulfide (7783-06-4) Tetrachloro-1,2-difluoroethane (CFC-112) (76-12-0) Tetrachloro-2,2-difluoroethane (CFC-112a)(76-11-9) Trichloro-1,1,1,2-trifluoromethane (CFC-113)(76-13-1) Toluene Diisocyanate (2,4 and 2,6 isomers)(91-08-7)

[1] Includes 2-methylpentane (CAS # 107-83-5), 3-methylpentane (CAS# 96-14-0), 2,2-dimethylbutane (CAS# 75-83-2), and 2,3-dimethylbutane (CAS # 79-29-8) or any combination of these.

[2] Fluorides refer to fluorine gas and inorganic, ionizable fluoride compounds, excluding HF. Included in this category class are compounds such as NaF, KF, CaF_2, NH_4F, and SiF_4.

Following the assignments, Dr. Dorman summarized that board members would come to the December meeting and provide a brief summary about their assigned compounds. They would recommend the best way forward and why. Dr. Starr noted that what is missing from the spreadsheet is the basis for each TLV. He thought that how the critical endpoint was determined and if newer data was available would comprise the bulk of the information needed for the next meeting.

Dr. Dorman inquired about the format for the compilation of information. Dr. Prusiewicz noted that the handouts from the 176th NCSAB meeting contained a rough template document detailing the type of information that would be needed for a consistent review. She said she would provide the materials the board asked for by the end of the next week. She also reiterated Dr. Rusyn's suggestion that board members include URLs of key studies and references (when available) to facilitate transparency and traceability of the evaluation process.

Public Forum
There were no comments from the public.

Other Business
None.

Planning for December 3, 2014 Meeting
Dr. Starr suggested that they had already discussed the planning for the meeting. Dr. Prusiewicz said if the board members could send their respective information to her by mid-November, she would compile and distribute shortly thereafter.

The meeting was adjourned at 4:00 PM.

Respectfully submitted,

Candace Prusiewicz, Ph.D., D.A.B.T.
Liaison, Science Advisory Board

These minutes were accepted at the 178th NCSAB meeting on December 3, 2014.

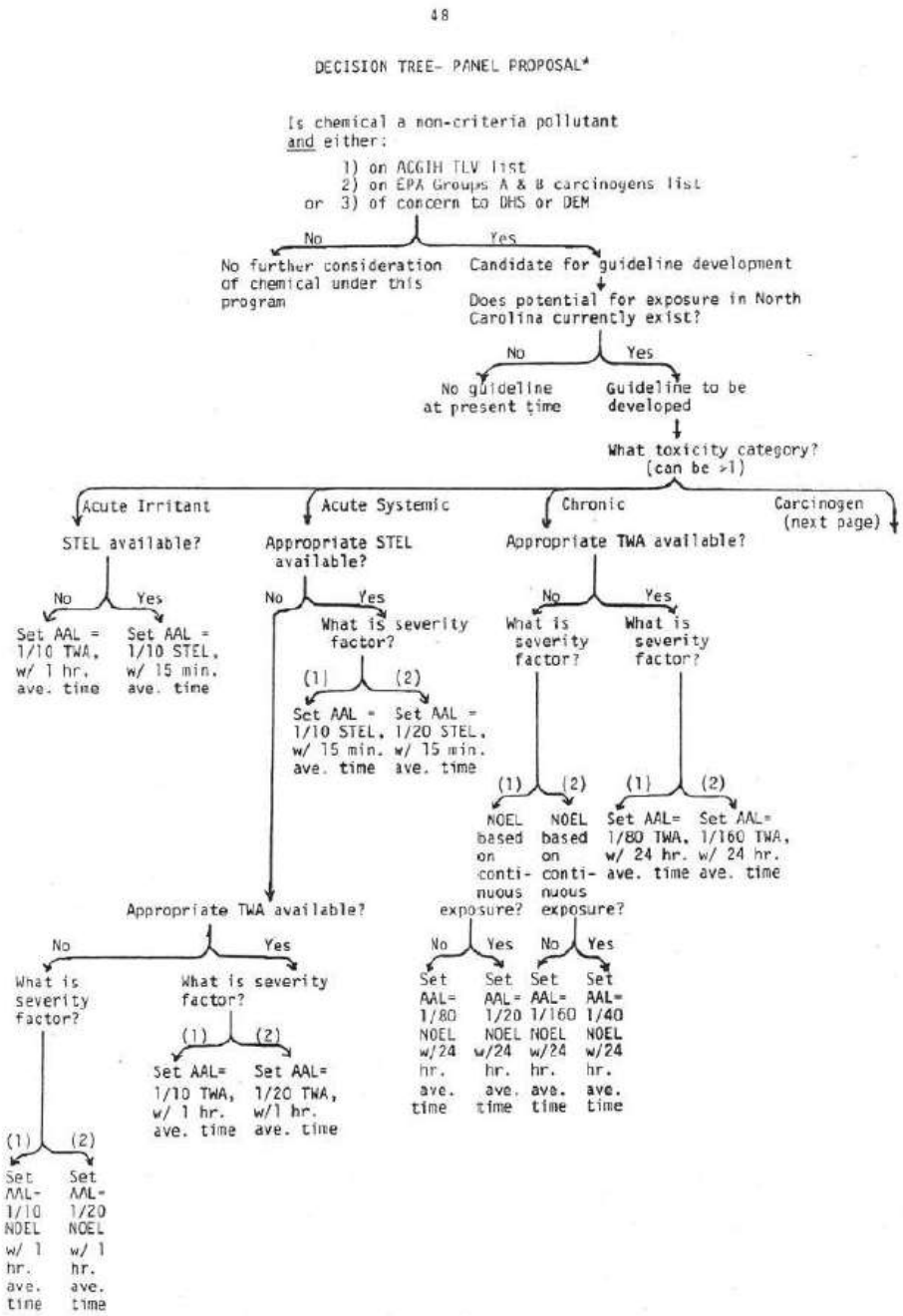
FINAL

Appendix 1

Air Pollutants unique to North Carolina TAPs List	CAS No.	NC AAL (µg/m³)	AAL Averaging Time	AAL Date	Critical Health Endpoint for AAL[1]	Methodology	NC Uncertainty Factor	1987-1988 ACGIH TLV (µg/m³)[2]	2013 ACGIH TLV (µg/m³)[2]	Difference bw/ TLVs	2012 Emissions (97 NC Counties) (pounds)	Demininis Reporting Levels (pounds/year)[3]	% Reduction in reported emissions from 1997	Emissions from Buncombe, Forsyth, and Mecklenburg counties (pounds) (2011 or 2012)	Percent of "Total" State Emissions from 3 Local Programs [7]
Acetic acid	64-19-7	3,700	1 hour (acute)[4]	1987 (1997)[4]	URT and eye irritation, pulm function	Factored TLV (STEL)	10	37,000 (STEL) 25,000 (TWA)	37,000 (STEL) 25,000 (TWA)	No change	542,872	100	81	87,178	14
Ammonia	7664-41-7	2,700	1 hour (acute)	1987 (1997)[4]	Eye damage, URT irritation	Factored TLV (STEL)	10	27,000 (STEL) 18,000 (TWA)	27,000 (STEL) 18,000 (TWA)	No change	2,689,284	100	55	254,912	9
Bromine	7726-95-6	200	1 hour (acute)[4]	1987 (1997)[4]	URT & LRT irritation, lung damage	Factored TLV (STEL)	10	2,000 (STEL) 700 (TWA)	1300 (STEL) 700 (TWA)	STEL reduced from 0.3 to 0.2 ppm	5,195	10	73	468	8
Dichlorodifluoromethane (CFC-12)	75-71-8	248,000	24 hour (chronic)	1987	Cardiac sensitization	Factored TLV (TWA)	20	4,950,000 (TWA)	4,950,000 (TWA)	No change	13,688	100	79	1656	11
Dichlorofluoromethane	75-43-4	500	24 hour (chronic)	1987	Liver damage	Factored TLV (TWA)	80	40,000 (TWA)	40,000 (TWA)	No change	2,183	100	95	405	16
Ethyl acetate	141-78-6	140,000	1 hour (acute)	1987	URT and eye irritation	Factored TLV (TWA)	10	1,400,000 (TWA)	1,400,000 (TWA)	No change	909,043	10	21	105,370	10
Ethyl mercaptan (ethanethiol)	75-08-1	100	1 hour (acute)	1987	URT irritation, CNS impariment	Factored TLV (TWA)	10	1,000 (TWA)	1,000 (TWA)	No change	1,682	10	392 (increase)	122	7
Ethylenediamine	107-15-3	2500 300	1 hour (acute) 24 hour (chronic)	1987	TLV basis not reported. NC doc indicates corrosivity and allergic potential.	Factored TLV (TWA)	10 (acute) 80 (chronic)	25,000 (TWA)	25,000 (TWA)	No change	640	1	99	0	0
Fluorides	Various	250 16	1 hour (acute) 24 hour (chronic)	1987	Bone damage, fluorosis	Factored TLV (TWA)	10 (acute) 160 (chronic)	2,500 (TWA)	2,500 (TWA)	No change	415,879	10	81	4111	1
Hexane, isomers except n-hexane (2-methyl pentane, 2,2-dimethylbutane, and 2,3-dimethylbutane, or any combination	Various	360,000	1 hour (acute)[4]	1987 (1997)[4]	CNS impairment, URT and eye irritation	Factored TLV (STEL)	10	3,600,000 (STEL) 1,800,000 (TWA)	3,600,000 (STEL) 1,800,000 (TWA)	No change	2,271,203	100	799 (increase)	36	0
2-methylpentane	107-83-5														
3-methylpentane	96-14-0														
2,2-dimethylbutane	75-83-2														
2,3-dimethylbutane	79-29-8														
Hydrogen sulfide	7783-06-4	120[5]	24 hour (chronic)	2006	Nasal lesions following 10 week exposure (rats) (Source: NC AAL document)	NOAEL	120	21,000 (STEL) 14,000 (TWA)	7,000 (STEL) 1,400 (TWA)	STEL reduced by a factor of 3 TWA reduced by a factor of 10	2,121,270	1	56	1066	0
Methyl ethyl ketone	78-93-3	88,500 3,700	1 hour (acute)[4] 24 hour (chronic)	1987 (1997)[4]	URT irritation, CNS and PNS impairment	Factored TLV (TWA) Factored TLV (STEL)	10 (acute) 160 (chronic)	885,000 (STEL) 590,000 (TWA)	590,000 (STEL) 885,000 (TWA)	No change	928,349	100	79	127,190	12
Methyl mercaptan	74-93-1	50	1 hour (acute)	1987	Liver damage	actored TLV (TWA	20	1,000 (TWA)	1,000 (TWA)	No change	374,500	1	53	145	0
Nitric acid	7697-37-2	1,000	1 hour (acute)	1987 (1997)[4]	URT and eye irritation, dental erosion	actored TLV (STEL	10	10,000 (STEL) 5,000 (TWA)	10,000 (STEL) 5,000 (TWA)	No change	11,358	100	74	106	1
Sulfuric acid	7664-93-9	100 12	1 hour (acute) 24 hour (chronic)	1987	Pulmonary function	actored TLV (TWA	10 (acute) 80 (chronic)	1,000 (TWA)	200 (TWA)	TWA reduced by a factor of 5	2,714,562	100	1	27,745	1
Tetrachloro-1,2-difluoroethane, 1,1,2,2- (CFC-112)	76-12-0	52,000	24 hour (chronic)	1987	Liver and kidney damage, CNS impairment	Factored TLV (TWA)	80	4,170,000 (TWA)	417,000	TWA reduced by factor of 10	NR	1,000	N/A	0	N/A
Tetrachloro-2,2-difluoroethane, 1,1,1,2- (CFC-112a)	76-11-9	52,000	24 hour (chronic)	1987	Liver and kidney damage, CNS impairment	Factored TLV (TWA)	80	4,170,000 (TWA)	833,000 (TWA)	TWA reduced by factor of 5	NR	1,000	N/A	0	N/A
Toluene diisocyanate,2,4 and 2,6-isomers	91-08-7	0.2[6]	24 hour (chronic)	2002	↓ FEV_1 in workers (Source = NC AAL document)	NOAEL	30	150 (STEL) 40 (TWA) *Applies to 2,4 isomer only	150 (STEL) 40 (TWA) *Applies to single or mixture of isomers	No change	635**	1	46	51	8
Trichloro, 1,1,2- trifluoroethane, 1,2,2- (CFC-113)	76-13-1	950,000	1 hour (acute)	1987 (1997)[4]	CNS impairment, liver damage	Factored TLV (STEL)	10	9,500,000 (STEL) 7,600,000 (TWA)	9,500,000 (STEL) 7,600,000 (TWA)	No change	NR	100	100	0	N/A
Trichlorofluoromethane (CFC-11)	75-69-4	560,000	1 hour (acute)	1987	Cardiac sensitization	Factored TLV (TWA)	10	5,600,000 (TWA)	5,600,000 (STEL)	Changed from TWA to STEL	2,820	100	94	2051	42

[1] Source = ACGIH 2013 TLVs and BEIs except where noted
[2] ACGIH ppm values for STELs and TLVs converted to µg/m3 using the formula:
[3] Deminimus reporting level: Recommended emission threshold for reporting to NC emission inventory. Emission quantities below threshold may or may not be reported (strictly voluntary).
[4] 1987(1997) - The Environmental Management Commission (EMC) adopted the 15-minute averaging time AALs as 1-hour averaging time AALs in 1997.
[5] Original 1987 AAL= 2,100 µg/m3. UF of 10 used for acute effects.
[6] Original 1987 AAL = 4.3 (TWA) and 14 (STEL). UF = 10 (Acute) and 80 (Chronic). (Decimal typo in original
[7] Emission inventory totals presented for rough comparison purposes only. Each inventory is constructed differently making an accurate compilation of data

Appendix 2



Source: Report and Recommendations of the Air Toxics Panel of the North Carolina Academy of Sciences to the Division of Environmental Management, North Carolina Department of Natural Resources and Community Development. Final Report (September 1986, p.48).