

Urban Air Toxics



North Carolina Division of Air Quality (DAQ)
Toxics Protection Branch

Why Urban Air Monitoring?

- US EPA “Air Toxics Monitoring *Concept Paper*”, April 7, 1999
 - Better define residual risks from hazardous air pollutants (HAPs)
 - Characterize impacts of HAPs on public health and the environment
 - Determine need for additional controls on toxic pollutant emissions
 - Develop and implement a national network

- Outgrowth of the National Air Toxics Assessment (NATA) process to
 - Characterize ambient concentration
 - Provide data to support & evaluate models (dispersion, fate & transport, risk)
 - Establish trends and evaluate the effectiveness of HAP reduction strategies
 - Form basis for national network

Urban Monitoring What?

- EPA's "Air Toxics Monitoring *Concept Paper*", April 7, 1999
- 33 air pollutants [core compounds] picked from list of 188 hazardous air pollutants (HAPs):
 - 16 volatile organic compounds (VOCs)
 - 3 aldehydes (carbon-oxygen compounds)
 - 8 metals
 - 7 semivolatile organics (SVOCs) and "other HAPs"

HAPs, TAPs, and Core Compounds

- ❖ HAP: Hazardous Air Pollutant (listed by EPA)
- ❖ TAP: Toxic Air Pollutant (listed by NCDAQ)
- ❖ Core Compound: a HAP that presents a high health risk due to long term exposure (i.e. 70 years) in an urban environment. Typically a carcinogen or chronic toxicant.

HAPs, TAPs, Core Compounds and

- ❖ Core Compound: one of the original 33 Urban Air Toxic HAPs listed in the *Concept* paper.
- ❖ Methods don't neatly match target compounds
- ❖ Satisfactory methods are lacking for some of the target compounds
- ❖ NC DAQ monitors what we can with what we have
- ❖ NC DAQ gradually expanded the monitoring as methods, equipment and personnel came on-line, but recent resource constraints have forced a reduction in monitoring.

The NC UAT Monitoring Network



Urban Sites

Asheville
Charlotte
Raleigh
Research Triangle Park (closed)
Wilmington
Winston-Salem

Rural Site

Candor

Collaborative Effort



Cooperating Agencies

NC DAQ Wilmington Regional Office

Western NC Regional Air Quality Agency

Forsyth County Environmental Affairs Department

Mecklenburg County Land Use and Environmental Services Agency

The following slides list the classes of chemical compounds that NC DAQ tests for beginning with

Hydrocarbons

Hydrocarbons are derived mostly from petroleum sources and are the major components of fossil fuels, and petroleum products as well as plastics, waxes and oils.

In urban environments, hydrocarbons (along with nitrogen oxides (NO_x) and sunlight) contribute to ozone production.

Examples:

- Benzene
- 1,3-Butadiene
- Toluene
- Ethylbenzene
- Styrene
- Xylenes

Halogenated VOCs

Volatile organic compounds that contain halogens such as chlorine, bromine, fluorine. They are often:

- Industrial solvents.
- Persistent in the atmosphere.
- Resist photochemical breakdown.
- Have chronic health effects.
- Also contribute to ozone formation.

Examples:

- Carbon Tetrachloride
- Vinyl Chloride
- Tetrachloroethylene
- Freons

Polar Compounds

Polar compounds are oxygenated compounds such as ethers, ketones, and alcohols.

Many of these compounds are used as gasoline additives so that emissions may be characteristic of those from mobile sources.

Examples:

- Methyl t-Butyl Ether
- Methyl Ethyl Ketone
- Methyl Isobutyl Ketone
- Ethyl Alcohol

Carbonyl Compounds

Organic compounds composed of carbon, hydrogen, and oxygen and at least one carbon-oxygen double bond.

Factors that effect airborne concentrations:

1. Combustion sources, motor vehicles, industrial processes and some natural sources that emit compounds directly into the air.
2. Photochemical reactions that form carbonyl compounds in the air, typically from oxidation of airborne hydrocarbons.
3. Photochemical reactions that consume carbonyls from the air, generally by photolysis or by reaction with hydroxyl radicals.

Examples:

•Formaldehyde

•Acetaldehyde

HAPs, TAPs, and Core Compounds

- ❖ HAP: Hazardous Air Pollutant (listed by EPA)
- ❖ TAP: Toxic Air Pollutant (listed by NC law)
- ❖ Core Compound: a HAP that presents a high health risk due to long term exposure (i.e. 70 years) in an urban environment. Typically a carcinogen or chronic toxicant.

UAT Monitoring Results

UAT Core Compounds

with detectable results

- *Acetaldehyde*
- *Benzene*
- *1,3-Butadiene*
- *Carbon Tetrachloride*
- *Formaldehyde*
- *Methylene Chloride*
- *Trichloroethylene*

DAQ TAPs

UAT Core Compounds

that were not detected

- *Chloroform*
- *1,3-Dichloropropene (cis & trans)*
- *Ethylene Dibromide*
- *Ethylene Dichloride*
- *Propylene Dichloride*
- *Tetrachloroethylene*
- *1,1,2,2-Tetrachloroethane*
- *Vinyl Chloride*

DAQ TAPs

HAPs and TAPs

with detectable results

- *Benzyl Chloride*
- *Carbon Disulfide*
- *Ethyl Acetate*
- *Ethylbenzene*
- *Freons 11, 12, & 113*
- *Hexane*
- *Propionaldehyde*
- *Styrene*
- *Toluene*
- *Xylenes*

DAQ TAPs

HAPs and TAPs

that were not detected

- *Bromoform*
- *Chlorobenzene*
- *p-Dichlorobenzene*
- *Ethylidene Chloride*
- *Methyl Bromide*
- *Methyl Chloroform*
- *MIBK*
- *MTBE*
- *Vinylidene Chloride*
- *Vinyl Acetate*
- *Vinyl Trichloride*

DAQ TAPs

Other Compounds of Interest

with detectable results

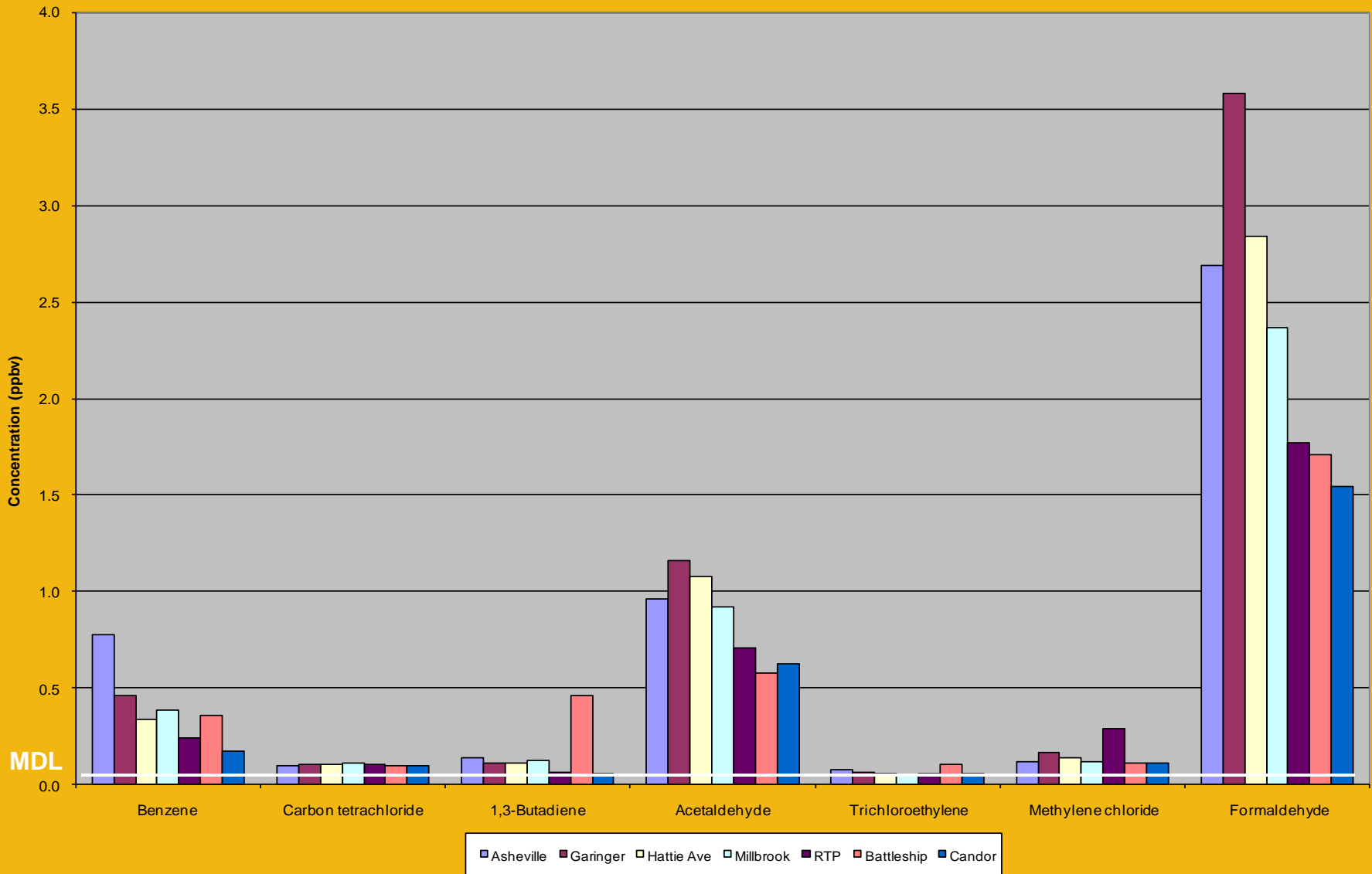
- *Acetone*
- *Benzaldehyde*
- *Butyraldehyde*
- *Cyclohexane*
- *Ethanol*
- *p-Ethyltoluene*
- *Heptane*
- *Isopropanol*
- *Methyl Ethyl Ketone*

Other Compounds of Interest

that were not detected

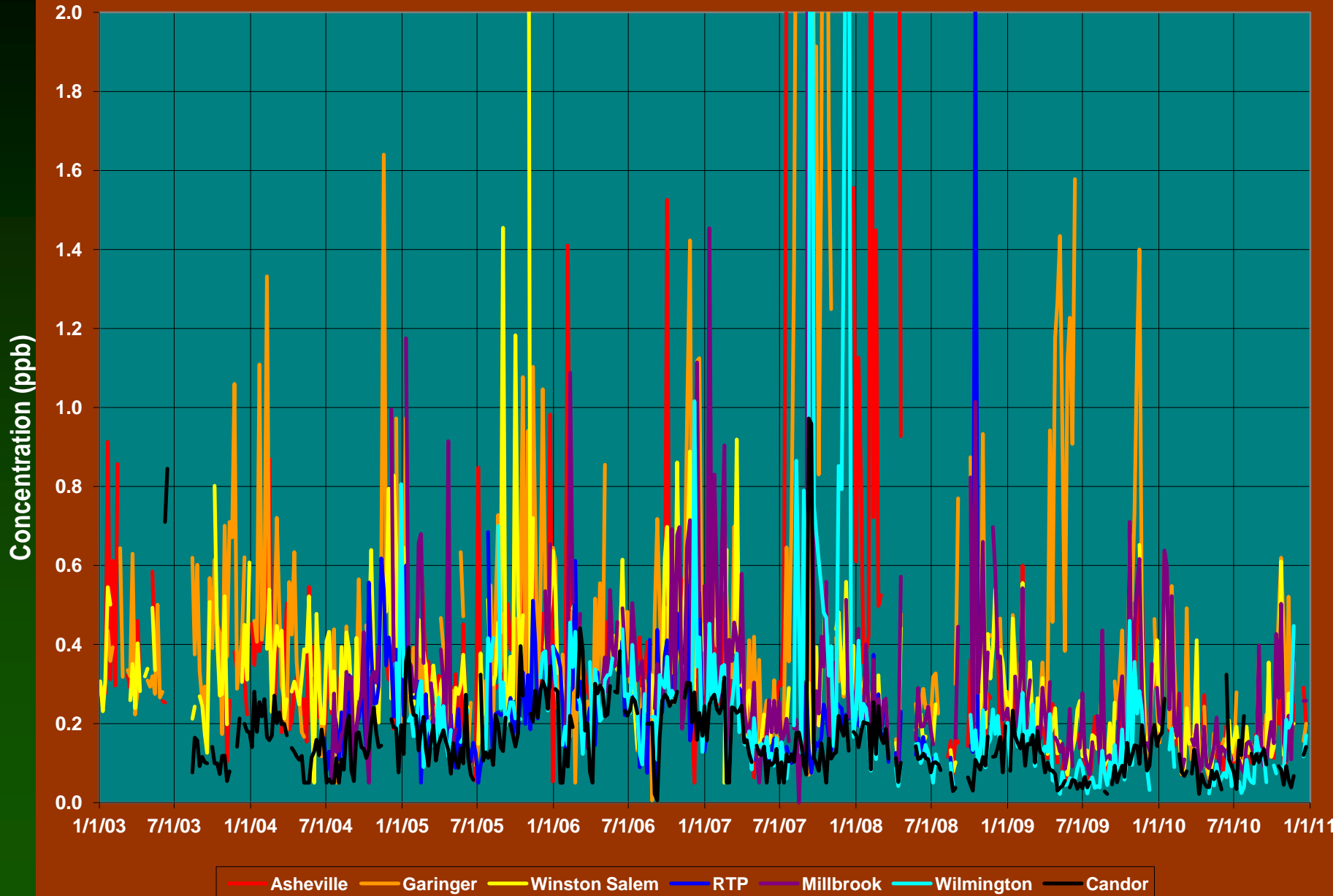
- *Crotonaldehyde*
- *Cyclohexane*
- *Dibromochloromethane*
- *Dichloroethenes (cis & trans)*
- *Dichlorobenzenes*
- *2,5-Dimethylbenzaldehyde*
- *Freon 114*
- *Hexaldehyde*
- *Isovaleraldehyde*
- *Methyl Butyl Ketone*
- *Valeraldehyde*
- *Tetrahydrofuran*
- *Tolualdehydes*

UAT Core Compounds: Average of 2002-07



MDL=method detection limit, the lowest concentration detected with any certainty

Benzene: Raw Data

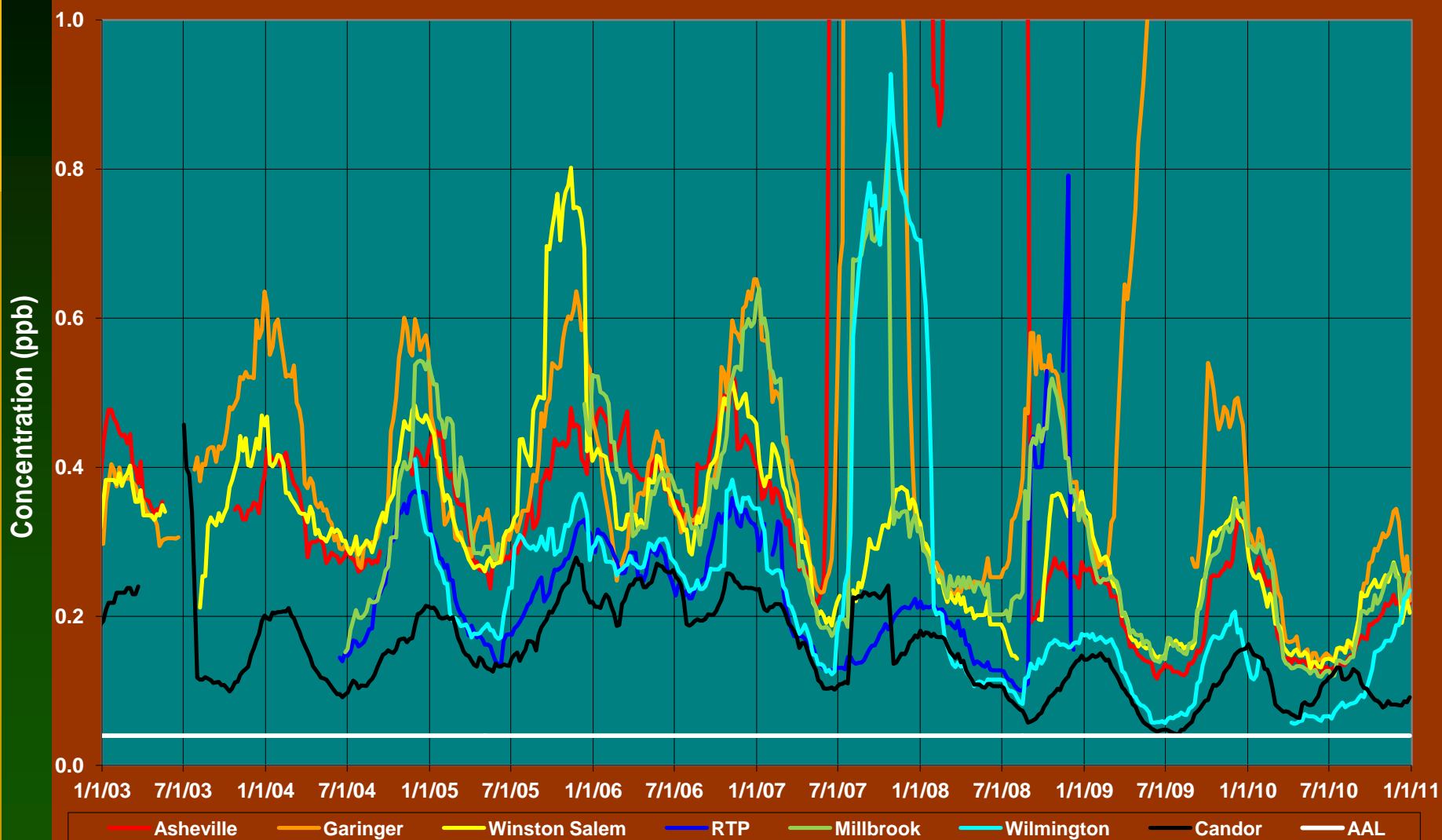


Benzene: 3-Month Averages

15 Point Rolling Averages

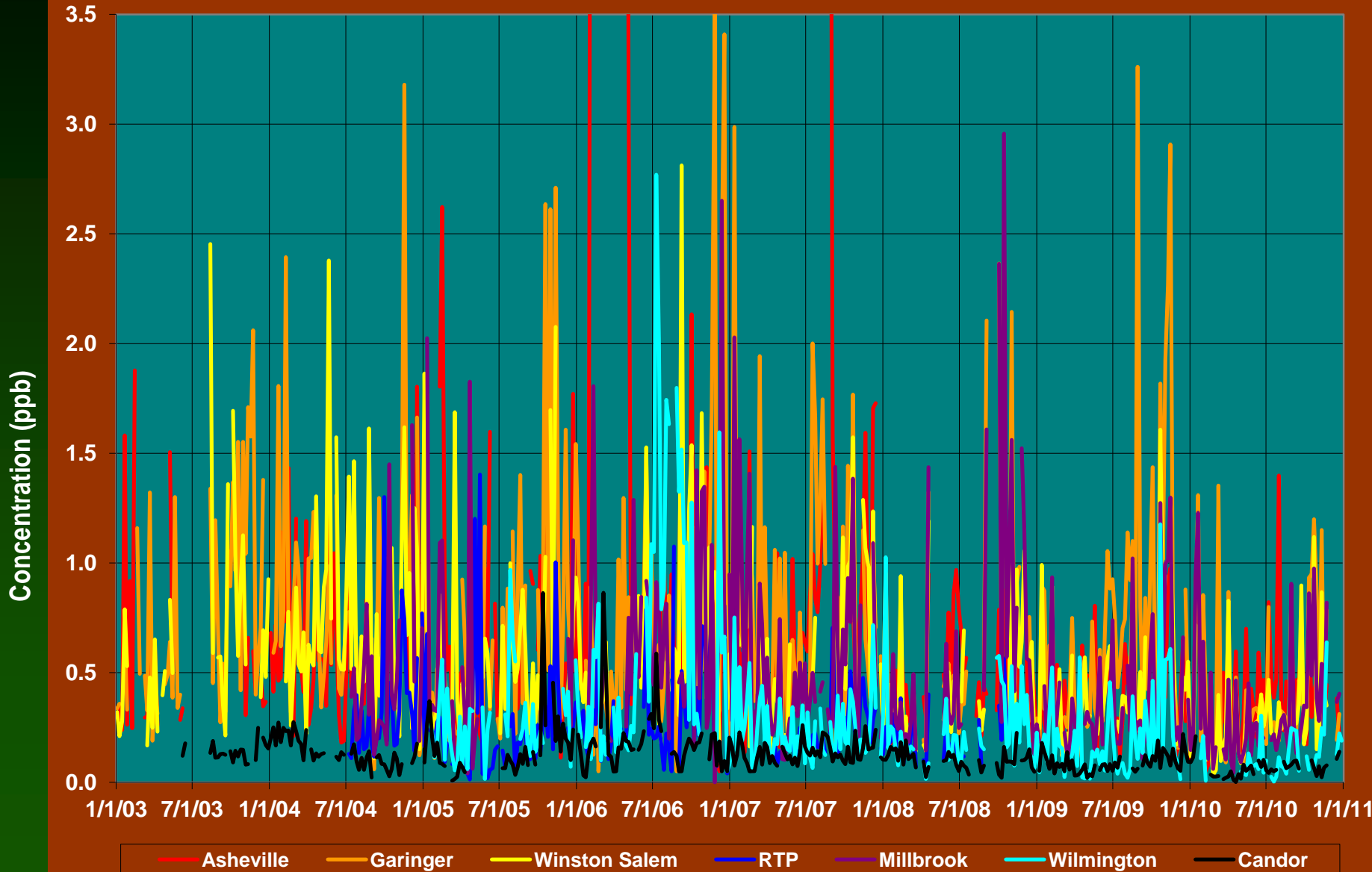
2010 MDL = 0.02 ppb

NC Regulations Acceptable Ambient Level (AAL) = 0.04 ppb



AAL= Cancer Benchmark: Concentration at which there is a 1 in a million cancer risk due to a lifetime exposure (70 years).

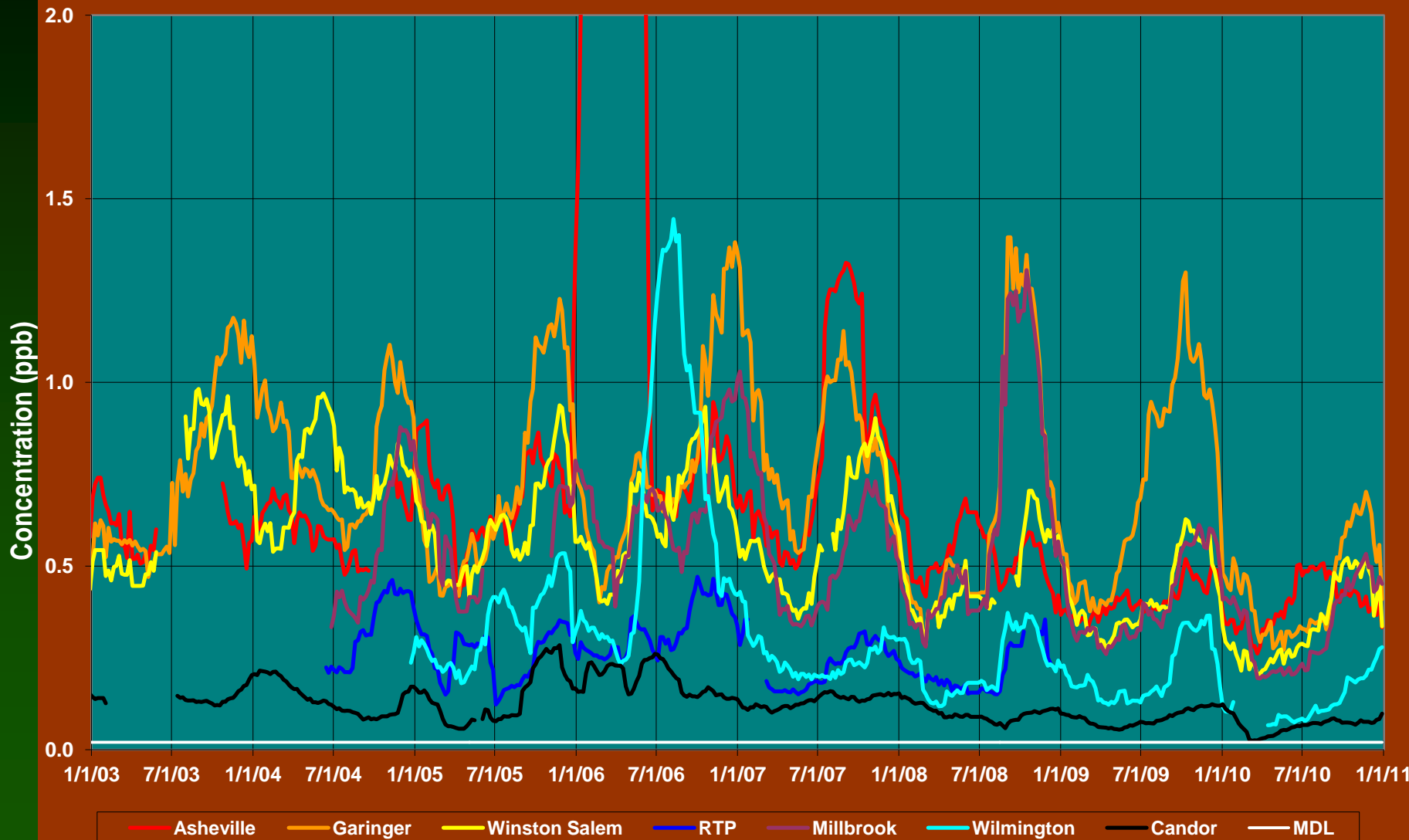
Toluene: Raw Data



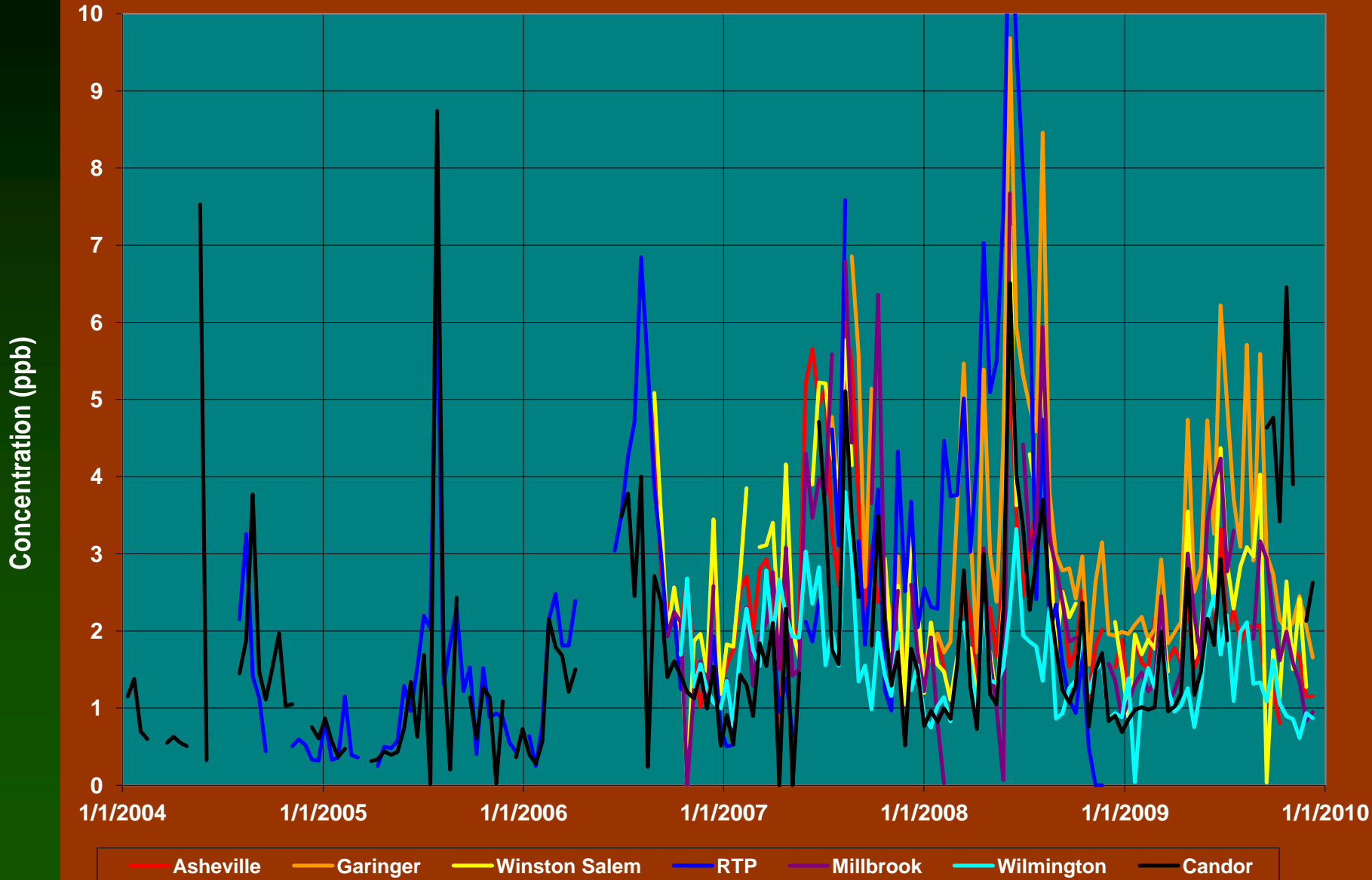
Toluene: 3-Month Averages

15 Point Rolling Average

2010 MDL = 0.02ppb

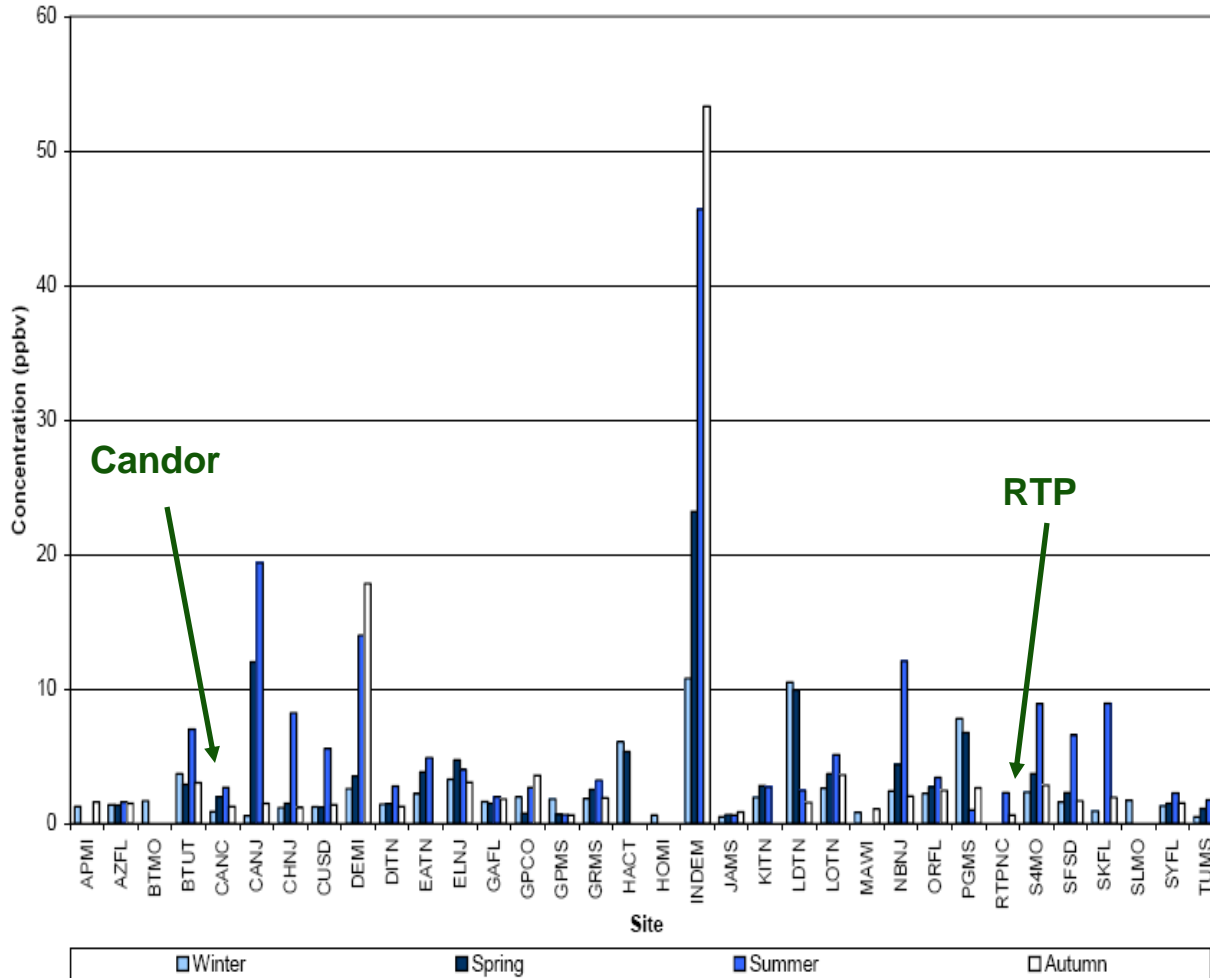


Formaldehyde: Raw Data

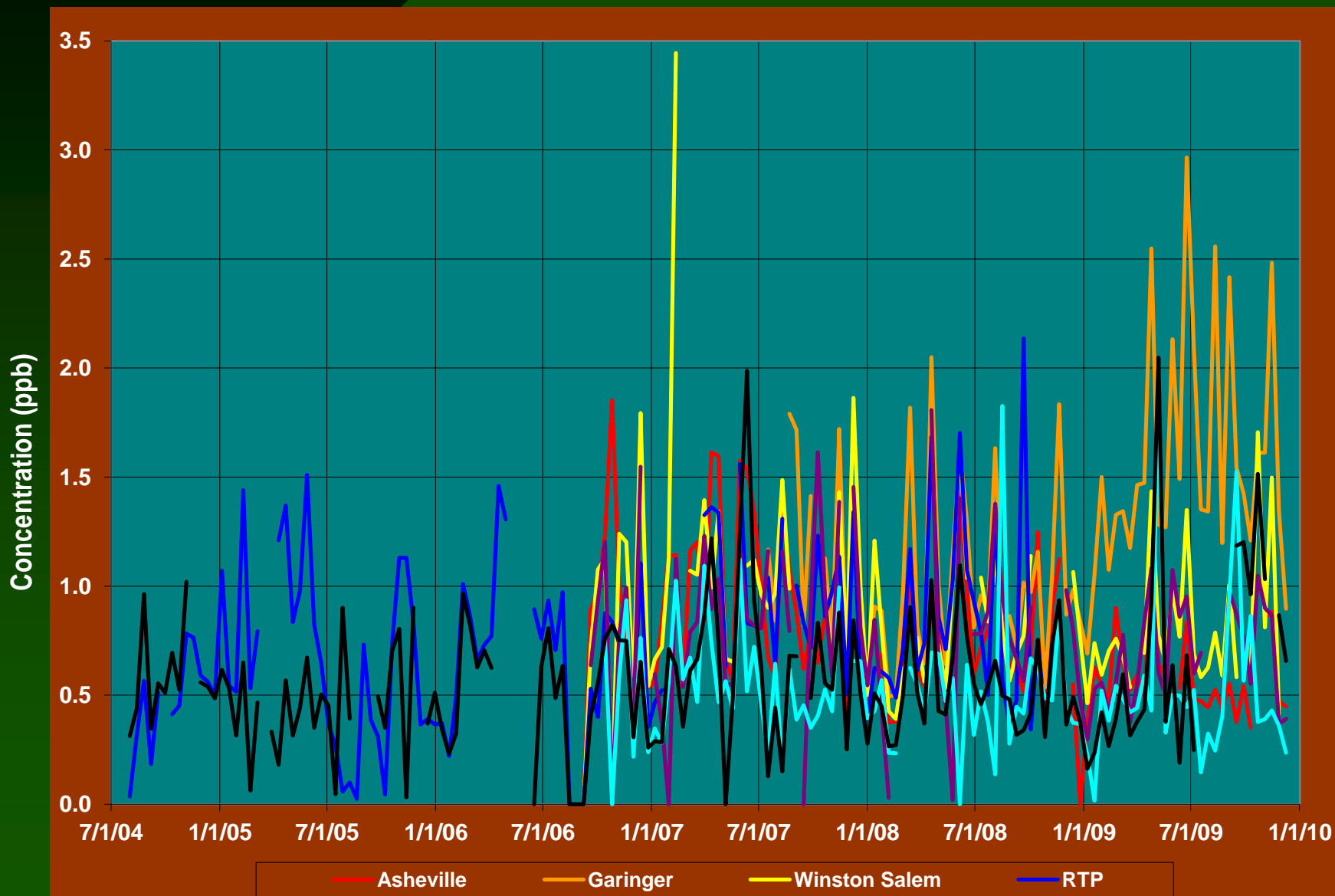


Formaldehyde: 2004 National Program

Figure 3-23. Average Seasonal Formaldehyde Concentration Comparison by Season



Acetaldehyde: Raw Data



Acetaldehyde: 2004 National Program

Figure 3-17. Average Seasonal Acetaldehyde Concentration Comparison by Season

