



## Air Intake Placement and Design and Fresh Air to Improve Air Quality

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### **Abstract**

1. Presentation on Chloramines and effects on patrons and facilities.
2. Present methods of Chloramine mitigation in pool. Pros and Cons.
3. Present methods Chloramines in air.
  - a. Alternate method of airborne chloramine mitigation.
4. Discussion of integrating water air, facility action to mitigate effects.

**Presented by: Don Baker & Randy Baxter**

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**Indoor Pool Air History**

**Thru Early 1980's**

100% Fresh Air with or without heat industry observation

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**Indoor Pool Air History**

**1980 - Present**

Dehumidification, heat and air conditions industry observations

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## Indoor Pool Air History

### What's Next

MAHC Draft Module

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## Model Aquatic Health Code

Ventilation CODE Section for the First 60-day Review  
Posted for Public Comment on 04/13/2011

### MAHC Ventilation Module Abstract

Health issues related to indoor pool use and associated pool water and air quality are increasingly being documented. The Ventilation Module is a first step towards improving air quality at indoor aquatic facilities and reducing associated health effects. The Ventilation Module contains requirements for new or modified construction that include:

- 1) Increased make-up required in addition to that required in the ASHRAE 62 standard for indoor pools.
- 2) Determination of the extra make-up air needed based on indoor venue water use type (e.g. flat water, agitated water or hot water) and venue or deck patron density (square feet/person)
- 3) Inclusion in calculations of additional make-up air from surge tanks or gutters that source capture of chloramines through exhaust.
- 4) Development and implementation of plans to reduce combined chlorine compounds in indoor aquatic facilities and inform facility patrons of their impact on building air quality.

<http://www.cdc.gov/healthywater/pdf/swimming/pools/mahc/structure-content/mahc-module-4.6.2-5.6.2-ventilation-code.pdf>

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## Air Intake Placement and Design Fresh Air to Improve Air Quality

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### Effects Of Poor Air Quality In Indoor Pools

This is why we care about indoor pool air quality

- Eye, nose and throat irritation
- Bronchial hyperactivity
- Possible link to asthma
- Possible link to cancer (organic chloramines)
- Building and equipment corrosion

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### Poor Indoor Pool Air Quality is Caused By Disinfectant By-Products (DBPs)

- DBPs are formed by the reaction of halogen disinfectants (chlorine and bromine) with nitrogen-containing compounds
- Organic chloramines
- Inorganic chloramines – monochloramine, dichloramine, trichloramine

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### Old Solution #1: Prevent DBPs From Forming

- Don't use chlorine or bromine
- Keep nitrogen-containing compounds out of the pool
  - Shower before entering water
  - No peeing in pool
  - No sweating in pool
  - No people in pool

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**Old Solution #2:  
Remove the DBPs After They Form**

- Medium-pressure UV to remove DBPs with each pass through the UV unit
- Solution by Dilution – mix with room air then dilute with outside air

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**Trichloramine (TCA) Vapor is the Problem**

- Trichloramine is
- Insoluble in water
  - Highly volatile
  - Very dense in gas phase
  - An extreme irritant

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**Trichloramine Vapor is Difficult to Remove**

- It is a very heavy (high density) gas
- It collects in low, out of the way places
- The typical indoor pool has low air flow across pool surface

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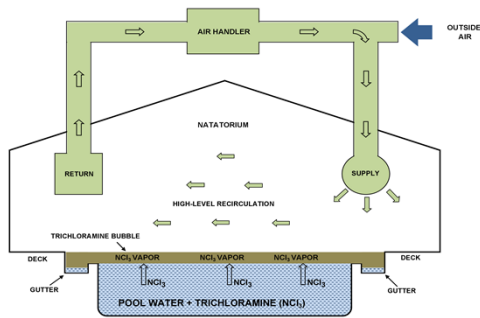
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### Typical Indoor Pool




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### A New Way to Deal with Trichloramine and Other DBPs

- Don't fight it - use trichloramine's characteristics to get rid of it
- Characteristics of Trichloramine
  - Doesn't mix with water (insolubility)
  - Exists primarily as vapor (volatility) in an active pool
  - Doesn't mix readily with air (density, 4-5 times heavier than dry air)
  - *Tends to stratify and collect at water level - forming the "chloramine bubble"*

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### Source Capture and Exhaust Strategy for Trichloramine Removal

- Do's and Don'ts of Source Capture and Exhaust
- Do not mix TCA vapor with room air
  - Do not recirculate TCA vapor
  - Do capture TCA vapor at its source
  - Do capture TCA as it forms
  - Do exhaust TCA to the outside

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### Source Capture and Exhaust Strategy for Trichloramine Removal

The How's and Why's of Source Capture and Exhaust

- Gentle room air circulation over the pool surface
- Room air circulation works with source capture air movement
- Source capture exhaust returns close to water surface
- Source capture exhausts DBPs outside
- Fresh ventilation air replaces the removed DBPs
- Source capture exhausts part of the code ventilation air requirement
- Air handler size/flow rates may be reduce when properly designed source capture system is used

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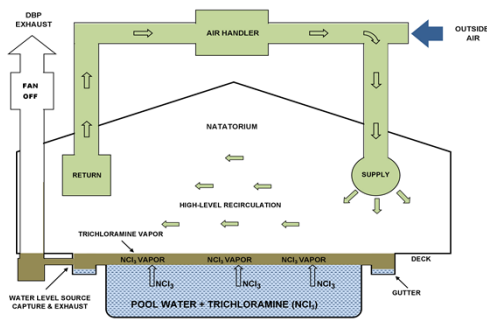
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### Source Capture and Exhaust – System Off




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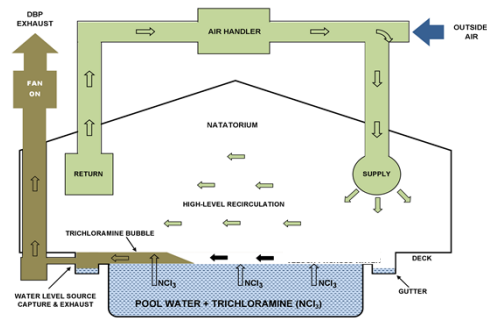
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### Source Capture and Exhaust – System Operating




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### Advantages of Source Capture and Exhaust

- The “chloramine bubble” never forms
- The system removes TCA vapor at its source – the waterline
- Source capture exhaust volume is part of the code-required exhaust volume/fresh air
- TCA vapor does not enter room air circulation
- Air handling costs can be reduced
- Corrosion damage to building and equipment is reduced
- *Greatly improves air quality and health impact on swimmers, coaches, pool personnel and fans*

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### New Pool

#### Source Capture Application

##### Option

- At Gutter
- At Building Perimeter
- Under Deck

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### How do we Test Airborne Trichloramines?

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## Jenks Trojan Aquatic Center

Jenks, OK

Jenks Trojan Aquatic Center is the only indoor 50-meter competition pool in Oklahoma. Its 50-meter length, the standard Olympic distance, is unusual for indoor high school pools. But its width and design enable it to be used sideways as a 25-yard pool. That will facilitate training and indoor meets, which generally use the shorter courses. The pool has a medium pressure UV and source capture exhaust. Pool commission in May 2011.

Application:

Results:

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## Westside Aquatic Center

Greenville, SC

Westside Aquatic Center has a 50-meter by 25 yard race pool and 25 yard teaching/lap pool. The pool has a medium pressure UV, dehumidification and source capture system. Completed in May 2011.

Application:

Results:

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## Renovation Observation with Source Capture

Rock Hill YMCA

The thirty year old Rock Hill YMCA has a 25 yard, 6 lane lap pool with low ceilings. The pool has a medium pressure UV, dehumidification and source capture system.

Original Existing Condition:

Facility Observations:

Source Capture Results:

Patron Perspective:

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## Mecklenburg Aquatic Club

Charlotte, NC

Mecklenburg Aquatic Club has a 50-meter by 25 yard heavy use training pool with 7-day a week programming and multiple major meets. It is a twenty year old facility with a medium pressure UV, dehumidification and extra exhaust fans.

Original Existing Condition:

Facility Observations:

Source Capture Results:

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## Mecklenburg County Aquatic Center

Charlotte, NC

The twenty year old Mecklenburg County Aquatic Center has a 50-meter by 25 yard training and high venue event pool. It also has a 25 yard, six lane lap pool with a low pressure UV and dehumidification system.

**50-Meter Race Pool**

**25 Yard Lap Pool**

Original Existing Condition:

Original Existing Condition:

Facility Observations:

Facility Observations:

Source Capture Results:

Source Capture Results:

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## Huntersville Family Fitness & Aquatics

Huntersville, NC

Huntersville Family Fitness and Aquatics has a 25 yard, 6 lane lap pool with a dehumidification system

Original Existing Condition:

Facility Observations:

Source Capture Results:

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## CONCLUSION

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## NOTES

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## NOTES

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