Indoor Air Quality in Schools Best Practices Manual

Indiana Department of Health

Division of Environmental Public Health

Revised July 2022

Introduction

Approximately one fifth of the U.S. population spends time every school day in a school. The air quality in school buildings can be affected by animals and insects, radon, vehicle exhaust, dirt, dust, mold, cleaning products and more. Indoor air quality problems can cause eye, nose, and throat irritation, nausea, tiredness, and long-term conditions. These health issues can lead to increases in health problems for students and staff and decreases in student performance and attendance and staff productivity. Many indoor air quality problems can be resolved by school staff through indoor air quality management. The Best Management Practices for Indoor Air Quality at Schools Manual was developed to help school staff identify hazards to indoor air quality and develop and implement guidance to remediate those situations.

The Best Management Practices for Indoor Air Quality at Schools Manual was prepared by the Indiana Department of Health (IDOH)-Environmental Public Health Division in response to the requirements of IC 16-41-37.5-2.5. Schools are not required to follow the manual or use any of the example policies that are included. The intent of the manual is to support schools in meeting the requirements of 410 IAC 33. In the event that any recommendations offered in this manual conflict with codes or laws, the codes or laws take precedence.

Users of the manual are welcomed to share feedback to the IDOH Indoor Air Program at 317- 351-7190. Provided feedback may be used to update and improve the Manual and may assist in identifying training and technical assistance needs related to school indoor air quality.

IDOH would like to thank the Indiana Department of Environmental Management and IDOH Asthma Program for providing resources found in this manual. We would also like to thank the U.S. Environmental Protection Agency for their online resources that are referenced in this guide.

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IAQ Coordinator / Committee

410 IAC 33 requires all schools to have an IAQ Coordinator. Having an IAQ coordinator and committee is a valuable resource for any school. These individuals can identify IAQ issues and help eliminate their sources before any complaints have been made to the school (or state).

An Indoor Air Quality Coordinator can be appointed at the school or corporate level but for bigger corporations having both is an advantage. These individuals are to serve as the lead contact point for parents, staff, students, and state IAQ inspectors, when there is a concern regarding IAQ. It is not expected that this individual be an expert on indoor air quality. When an issue is brought to their attention, they should know who to notify to see that the issue is addressed. If the school has an IAQ committee, they would be an active participant in the committee. The coordinator position should not require a large time commitment. For the individual to be effective they must have ready access to the School Nurse, Head of Maintenance, Principal, and Superintendent.

Schools wishing to start an IAQ committee should look at EPA's (U.S. Environmental Protection Agency's) "Tools for Schools" program. It will provide guidance in establishing a new program or expanding on an existing program. The committee works with the school to help establish guidelines that will improve air quality at the school. They can help educate all members of the school, both students and staff, on the risks from poor air quality and steps that can be taken to improve air quality both at school and at home. The EPA's "Tools for Schools" information can be found at: http://www.epa.gov/iaq/schools/

Schools with additional questions may contact the below representative with the Indiana Department of Education:

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Indiana Department of Education
South Tower, Suite 600
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Indianapolis, IN 46204
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Housekeeping and Maintenance

Proper application of routine housekeeping practices can reduce many allergens and asthma triggers making the school a healthier environment for all occupants. Below is a list of suggestions that can be used in evaluating your program.

1 Chemicals
   a. Protect yourself and coworkers. Follow all safety instructions.
   b. Choose the least hazardous chemical that safely performs the task.
   c. Prepare solutions following manufacturer's instructions, never exceed maximum strength.
   d. Never blend chemicals unless specifically allowed on the label.
   e. Use chemical for purpose designed, i.e. Never use a floor cleaner on a desk.
   f. Properly label containers
   g. Store chemicals safely, following rules for compatibility, spill guards, temperature, and ventilation.
   h. Purchase in smaller quantities to avoid storage of large volumes over extended periods.
   i. Properly dispose of excess material that is outdated, no longer usable, or no longer needed.
   j. When ordering products consider fragrance free options. Fragrances can be asthma triggers and are unnecessary in most situations.

2 Trash
   a. Empty waste containers, both indoor and outdoor, in a timely manner to avoid attracting insects and rodents. This includes large containers such as dumpsters.
   b. Empty recycling containers in a timely manner.
   c. Change liners on a routine basis and whenever needed.

3 Dusting/ Sweeping
   a. Airborne dust often carries allergens and can be an asthma trigger so use precautions if performing these operations when children are present.
   b. Micro-fiber cloths are much better at trapping dust particles and reduce the particles release into the air.
   c. It is encouraged to use color coded cleaning cloths for various types of surfaces to avoid cross contamination.

4 Mopping

a. After mopping, dry and ventilate to avoid high humidity situations.
b. Any chemicals with warnings of respiratory hazards should not be used when children are present, and the area should be properly ventilated prior to reentry.
c. It is encouraged to use color coded cleaning materials for various surfaces to avoid cross contamination.

5 Vacuuming
   a. Vacuum should have proper filter system to avoid dust being released into the air.
   b. Develop a vacuuming schedule that ensures carpets are kept clean.

6 Carpet Cleaning
   a. Spot clean spills as soon as possible to avoid mold growth.
   b. Dry as quickly as possible and ventilate to avoid high humidity.
   c. Air conditioners are not dehumidifiers. They will remove some moisture but not large amounts. Remember colder is not always better.
   d. Develop schedule to keep carpets clean. High traffic areas may need more frequent cleaning.

7 Florescent light bulbs
   a. Florescent light bulbs contain mercury and should be stored and disposed in a safe manner. Broken bulbs can release mercury vapor into the air so they should be cleaned up and properly stored until disposal.

8 Storage containers
   a. Storage containers should be the appropriate size and shape and located so as to facilitate proper cleaning of the classroom.

Asthma and Schools

Asthma is a chronic respiratory disease that intermittently inflames, narrows, and fills the airways of the lungs with mucus, making it difficult to breathe. Symptoms may include wheezing, breathlessness, chest tightness, or nighttime or early morning coughing. Symptoms can range from mild to severe and can happen rarely or every day. Asthma is one of the most common long-term diseases of children, and adolescents, but can also impact adults.

Indoor allergens and irritants play a significant role in triggering asthma episodes. Effectively managing asthma requires a combination of medical management of the disease and avoidance or mitigation of environmental triggers. It is important for schools to reduce environmental irritants because students spend a majority of their time in school buildings. Asthma is one of the leading causes of school absenteeism. Approximately one in two children with asthma miss at least one day of instructional learning, each year, due to asthma. Nationally, in 2018, 2.2 million children aged 5-17 years missed more than 7.9 million school days.[1]

Common Asthma Triggers Found in Schools

Environmental Asthma Trigger Found in Schools	Asthma Management Tip for Schools
Tobacco Smoke	Adopt and enforce comprehensive tobacco-free schools policies including school grounds and events including second and third hand smoke.
Cockroaches and Pests	Use Integrated Pest Management
Mold	Fix leaks and moisture problems Dry wet areas within 24-48 hours to prevent mold. Clean hard, moldy surfaces with water and detergent and dry. Replace surfaces that cannot be properly cleaned.
Dust Mites	Dust and vacuum thoroughly and regularly. Keep classrooms free of clutter Wash stuffed toys
Animal Dander	Remove animals from classrooms

[1] https://www.lung.org/research/trends-in-lung-disease/asthma-trends-brief/trends-and-burden?msclkid=96999d31c0dc11ec9e0944619522170c

	Keep animals away from sensitive students and ventilation

Other asthma triggers that can be found in schools include cleaning products, pesticides, and school bus exhaust. More information about controlling these environmental triggers can be found in other sections of this manual.

Resources:

- CDC Asthma: https://www.cdc.gov/asthma/default.htm
- CDC School and Childcare Providers: https://www.cdc.gov/asthma/schools.html
- EPA Managing Asthma in the School Environment: https://www.epa.gov/iaq-schools/managing-asthma-school-environment
- EPA Framework for Effective School Indoor Air Quality Management: Framework for Effective School IAQ Management | Creating Healthy Indoor Air Quality in Schools | US EPA
- ALA Asthma-Friendly Schools Initiative Toolkit: https://www.lung.org/lung-health-and-diseases/lung-disease-lookup/asthma/asthma-education-advocacy/asthma-friendly-schools-initiative/toolkit/

Ventilation in Schools

Under 410 IAC 33-4-2 schools are required to supply outside air to classrooms when occupied. The rule addresses this through defining a maximum concentration of carbon dioxide for the classroom at 700 parts per million (ppm) over the outdoor concentration. In ASHRAE Standard 62.1-2007 there is a formula where air flow rates can be calculated based on carbon dioxide concentrations. Using this formula, it will require approximately 15 cubic feet per minute (cfm) of outside air per occupant to maintain a carbon dioxide concentration at or below 700 ppm over the outdoor concentration.

410 IAC 33-4-2 also addresses ventilation requirements for specialty rooms such as art, shop, or science. This could also apply to regular classrooms where there are special activities such as using a 3-D printer.

Covid-19 has brought to light the importance of ventilation as one portion of a multifaceted approach to reducing the spread of airborne diseases. Studies have found that by not only increasing outside air beyond what is required, improving filtration of recirculated air, or the use of stand-alone air purifiers can be beneficial.

Resources:

- Improving Ventilation in Schools, Colleges, and Universities to Prevent COVID-19 https://www.ed.gov/improving-ventilation-schools-colleges-and-universities-prevent-covid-19
- Ventilation in Schools and Childcare Programs https://www.cdc.gov/coronavirus/2019-ncov/community/schools-childcare/ventilation.html
- Is CO2 an Indoor Pollutant? Direct Effects of Low-to-Moderate CO2 Concentrations on Human Decision-Making Performance https://ehp.niehs.nih.gov/doi/10.1289/ehp.1104789

Live Animals in Schools

This information does not apply to Service Animals. For information on service animals visit Service Animals: Resources: ADA-Indiana: Americans with Disabilities Act (adaindiana.org).

Additional information regarding animals in the classroom can be found at the Center for Disease Control (CDC) at https://www.cdc.gov/mmwr/preview/mmwrhtml/rr5605a5.htm.

EPA states that animals can be a source of allergens, asthma triggers and microorganisms that may cause infectious diseases. If the school decides animals are a useful educational tool, and allows them in the school building, there are certain steps that should be taken to minimize students' risk of asthma, allergy attacks or exposure to pathogens.

1) Notify parents of the plan to have an animal in the classroom. Inquire if the animal is an asthma or allergy trigger for their child. If any parent confirms this is an issue, reconsider having the animal in the classroom that year.

2) Keep animals in cages or localized areas as much as possible; do not let them roam.

3) Clean cages regularly. Consider using disposable gloves when cleaning.

4) Locate animals away from ventilation system vents to avoid circulating allergens throughout the room or building.

5) Locate sensitive students as far away from animals and habitats as possible.

6) Keep animals away from upholstered furniture, carpets, and stuffed toys.

7) Store food and bedding materials in sealed containers to avoid attracting pests.

410 IAC 33-4-7 (d) states:

Schools allowing animals in the classroom shall have a written policy addressing the following:

1) What animals are allowed

2) When animals are allowed in classrooms for educational purposes
3) The duration of the animal's stay in a classroom
4) Housekeeping requirements
5) How issues with students or staff allergic to the animal will be addressed

Below is an example policy that schools can adopt or use as a template for their own policy.

EXAMPLE POLICY STATEMENT:

Live animals with the exception of fish in aquariums are only to be in the school for educational purposes. At no time will animals considered dangerous be brought into the classrooms.

When an animal is to be brought into a classroom a note will be sent home with the students of that class notifying the parents that an animal will be present. If known in advance this will be done at the beginning of the school year. It is up to the parents to notify the teacher or principal if their student is allergic to the animal. Upon such notice, the Principal will confer with the Teacher and determine what options are available including having the student transferred to a different classroom without animals or changing to a different species with no allergy problems, or not having an animal in the classroom. The school will not reveal the name of the student with allergy issues to students or parents. If after an animal is brought into the classroom, the parent finds their student is allergic to the animal, the school will work with the parent and teacher to resolve the issue. If necessary, housekeeping will clean all surfaces in the classroom to remove any animal dander that may still cause an allergic reaction by the student. Food and animal bedding shall be stored in appropriate sealable containers to avoid attracting pests.

Examples of educational purposes where animals would be in the classroom for an extended period are:

1) Animals used in health class to demonstrate affects of different diets.
2) Animals used in biology to show developmental changes or diversity.
3) Eggs incubated to show development.

Examples of educational purposes where animals are in the classroom for one day or less:

1) Pets/animals brought into the classroom to allow students exposure to a variety of species.

2) Pets/animals used to demonstrate obedience training.

This is not a comprehensive list of appropriate uses. The principal, when requested by a teacher, has the authority to determine if it is appropriate to bring an animal into the classroom.

Cleaning: Cages shall be cleaned by the teacher in charge of the animal (not students) on a routine basis as to avoid offensive odors or pest issues. Aquariums with fish are to be maintained by the teacher in charge of the aquarium including cleaning as needed.

When appropriate, teachers may allow students to handle and/or feed the animals.

Radon in Schools

What is Radon?

Radon is a radioactive gas that does not have color, taste, or odor. It is from the natural breakdown of uranium, which is found in most soil types in Indiana and the United States. Radon can move from the ground into buildings through cracks and holes in the foundation. Radon decays into radioactive particles that can be trapped in your lungs. Small bursts of radiation are released as the particles break down, which can cause lung damage. Radon is estimated to cause 21,000 lung cancer deaths a year, making it the second leading cause of lung cancer, after smoking. School is the second largest contributor of radon exposure for children and staff, after the home.

Radon levels can vary between buildings that are next door to each other because of differences in construction. Factors that impact radon entering your school include:

1. The concentration of radon in the soil gas and permeability of the soil under the building

2. The structure and construction of the building

3. The type, operation, and maintenance of the heating, ventilation, and air-conditioning (HVAC) system

HVAC systems can influence radon in schools through:

1. Ventilation
   - Increasing ventilation dilutes the radon concentration with outdoor air
   - Decreasing ventilation allows radon gas to build up
2. Pressurizing
   - Pressurizing a building keeps radon out
   - Depressurizing a building draws radon in

The only way to know the radon levels in your school is to test for radon.

Radon Testing

Radon testing in schools is highly recommended by the Indiana Department of Health, but not required by Indiana law. The EPA action level for radon is 4 pCi/L. The only way to know the radon concentration in a room is to test. There are two types of radon test:

short-term and long-term. Short term tests take between two days and three months and long-term test are longer than 3 months. Tests should be done with certified radon testing devices, which are approved by the National Radon Proficiency Program (NRPP) and the National Radon Safety Board (NRSB).

ISDH recommends following the testing protocol found in the current version of ANSI/AARST MALB-2014 with 1/2021 REVISIONS “Protocol for Conducting Measurements of Radon and Radon Decay Products in Schools and Large Buildings” https://standards.aarst.org/

Testing should be conducted in all rooms that are frequently occupied in contact with the ground along with 10% of occupied second and third floor rooms and at least 1 test for floors four and above. Use the chart below to determine which rooms in your school should be tested.

Foundation Type	Testing Recommendations
Slab-on-Grade Design	Measure frequently occupied rooms in contact with the ground.
Open-Plan or Pod Design	Measure each section separately. If moveable walls are absent or inoperable, measure the pod as one room with detectors every 2,000 square feet.
Crawl Space Design	Measure frequently occupied rooms directly above the crawl space.
Basement Design	Measure all frequently occupied basement rooms, rooms with floor or wall ground contact, and rooms directly above basement space that is not frequently occupied.

Initial radon testing identifies rooms that have a potential for elevated radon levels during the school year. It is recommended that the test should be conducted under the following conditions:

1. Closed conditions: windows and doors should be closed except for normal exit and entry.

2. Conditions are required to be closed for 12 hours prior to and during tests lasting less than 4 days. For tests 4 days or longer, closed conditions are recommended 12 hours prior to and during the test.

3. HVAC operation should be normal for 2-5 day tests.

4. During colder months, October through March.

5. During normal weather and barometric conditions. Tests should not be conducted during storms and high winds.

6. During normal operation of the building. Structural and HVAC system changes should not be going on during the test.

A list of radon testing professionals can be found on the Indiana State Department of Health website at https://www.in.gov/isdh/24346.htm.

Retesting:

If you have initial test results at or above 4 pCi/L, additional testing and possibly mitigation is needed. Test results between 4 pCi/L and 8 pCi/L should be followed up with a short term continuous monitoring test or a long term test. Results that are equal to or greater than 8 pCi/L require quick action and another short-term test should be conducted. If results are near 100 pCi/L, contact ISDH-Indoor Air Program at 317-351-7190 and consider relocating until levels are reduced.

If test results are below 4 pCi/L and no mitigation is needed, all frequently occupied rooms in contact with the ground should be retested in the future. EPA recommends at least once every 5 years. As buildings age, cracks and other structural changes can change the amount of radon that enters. Testing should also be done before and after major renovations or changes to the HVAC system are made.

Reducing Radon:

If testing reveals high radon levels, there are mitigation options to lower the level of radon in your school. Since school buildings are more complicated structures than houses, a mitigation strategy should be developed by a licensed Radon Mitigation Professional. A list of Indiana licensed mitigators can be found at https://www.in.gov/isdh/24346.htm. Studies conducted by the EPA indicate that the following are effective mitigation strategies for school buildings:

1. Active sub-slab depressurization (ASD): venting radon gas from beneath the building slab.

2. HVAC pressurization/ventilation: using the HVAC system to pressurize and ventilate the building.

The strategy used to reduce radon levels in your school building depends on local building code requirements, building construction, occupancy patterns, and radon levels

Resources:

- EPA's Radon in Schools: https://www.epa.gov/radon/radon-schools
- EPA's *Radon Measurement in Schools* guide: https://www.epa.gov/sites/production/files/2014-08/documents/radon_measurement_in_schools.pdf
- ISDH Radon: https://www.in.gov/isdh/24346.htm
- National Radon Proficiency Program (NRPP) Approved Testing Devices: http://aarst-nrpp.com/wp/certification/approved-devices/
- National Radon Safety Board (NRSB) Approved Testing Devices: http://www.nrsb.org/devices/device-listings/
- Minnesota Department of Health-Guidance for Radon Testing in Minnesota Schools: https://www.health.state.mn.us/communities/environment/air/docs/schools/radontestingschools18.pdf
- New Jersey Department of Environmental Protection- School Radon Testing Program Sample Letter to Parents: https://www.njradon.org/download/sr_pn.pdf

HVAC Maintenance

The best way to ensure routine maintenance occurs for all HVAC units is to have SOP's and a maintenance logbook for the HVAC systems. Often, due to lack of repair or maintenance, HVAC systems, if not the cause, exacerbate indoor air quality problems. The following list contains items that can be included in a maintenance program to reduce this risk. This list does not include maintenance of the mechanical components such as motors. Those items should be addressed following manufacturer's recommendations.

IAC 33-4-5 requires schools to establish and maintain a written procedure for routine maintenance of HVAC systems.

1. Unit Ventilators – routine maintenance should include the following
    a. Clean intake and exhaust vents
    b. Clean drip pan and condensate drain line
    c. Clean coils
    d. Clean all accessible areas of interior of unit
    e. Ensure fresh air damper linkage is functioning
    f. Clean air intake on exterior of building
    g. If intake on ground level, check for pooling water along building.
    h. Change filter (we suggest at minimum use a good quality pleated filter)
    i. Noise level should not be disruptive to students and teacher
    j. With fresh air damper at lowest setting, supply sufficient outside air to maintain a maximum of 700 ppm carbon dioxide over the outdoor measurement (ASHRAE recommends 15 CFM outside air/person for classrooms)
    k. All cleaning residue that causes irritation or respiratory distress should be flushed from system prior to students returning to classroom

2. Central systems- routine maintenance should include the following
    a. Clean intake and exhaust vents in rooms
    b. Examine ductwork behind supply and return vents for accumulated dust and or mold
    c. Clean coils.
    d. Clean drip pan and condensate drain line
    e. Ensure dampers are functioning properly
    f. On automatic systems, with damper set at lowest setting, ensure minimum outside air to maintain maximum of 700 ppm carbon dioxide over the

outside measurement (ASHRAE recommends 15 CFM outside air/person for classrooms).

g. Check that fresh air intake is not blocked and no standing water or mold near intake. Do not allow birds to roost or nest on vents
h. Ensure individual thermostats are working
i. Ensure individual room dampers are functioning properly
j. Clean or replace filters (use good grade of filter)
k. Systems should have been balanced to ensure minimum movement of odors from one area to another and minimum fresh air requirement is met for all rooms
l. Examine outside air intakes for cleanliness and ensure no standing water near the intake
m. All cleaning residue that causes irritation or respiratory distress should be flushed from system prior to students returning to classroom
n. Check integrity of ductwork

3. All systems
    a. Check to see area in front of air intakes is unobstructed (keep shrubs a minimum of 3 feet from air intakes)
    b. Check to ensure there is no standing water near air intakes
    c. Use air filters that have an acceptable minimum efficiency rating.
    d. Locate waste containers (both indoor and outdoor) away from any air intakes or air return vents
    e. On new construction or renovations, air intakes and exhausts should be located so as to minimize the possibility of re-entrainment of exhaust gasses, car exhausts, or other outdoor pollutants

Resources:

- EPA's Creating Health Indoor Air Quality in Schools
  https://www.epa.gov/iaq-schools

- EPA's "Design Tools for Schools" Heating Ventilation and Air Conditioning Systems
  https://www.epa.gov/iaq-schools/heating-ventilation-and-air-conditioning-systems-part-indoor-air-quality-design-tools

- Minnesota Dept. of Health "Indoor Air Quality (IAQ) in Schools"
  https://www.health.state.mn.us/communities/environment/air/schools/index.html

The following page is an example maintenance chart produced by the Minnesota Department of Health and amended by the Indiana State Department of Health

Attachment 4: Example Preventive Maintenance Schedule

Edit according to operational needs of each school building.

	Every 3 Months	Every 6 Months	Annually	Every 2 Years	As Needed
HVAC System					
Filters Replaced/Fitted Properly	x				x
Fan / Air Flow Direction	x				
Belt Tension			x		
Drain Pans Empty/Clean	x				
Drain Condensate lines cleaned	x				
Overall Cleanliness of Ducts and Unit			x		
15-20 percent of Air Delivered is Fresh				x	
Calibration of System				x	
Thermostats Functional	x				
CLEANING SCHEDULE					
Cleaning of Heating Coils			x		
Cleaning of Cooling Coils		x			
Cleaning of Drainage Areas		x			
Cleaning of Ductwork					x
AIR INTAKE					
Avoid Obstructions	x				
Air Flows into duct	x				
No Pollutant Sources Nearby	x				
(garbage, idling vehicles, exhaust)					
Dampers Operational	x				
Motors Operational	x				
LOCAL EXHAUST SYSTEMS					
Proper Exhaust Volume			x		
Air Direction Correct			x		
Fan Functional			x		
Outdoor Vent Checked / Cleaned			x		
OTHER					
Sewage Traps Filled with Water Weekly	x				
Hazardous Chemicals Storage		x			
Walk-off Mat Cleanliness	x				
Carpet Cleanliness	x				
Leaks, Stains, Moisture Inspection	x				
Clean All Classroom Tables, Diffusers, Shelves	x				x
Deep Clean Carpets, Strip and Wax Floors		x			x
Water-stained ceiling tile should be replaced	x				

410 IAC 33-4-5(C) For new construction, or renovation of the HVAC system, all air supplies and air returns shall be ducted. Open return plenums above the ceiling are not allowed.

Rule Interpretation:

Renovations:

March 5, 2013 - For the purpose of this rule, replacement with "like kind" is considered a repair even if the new units are of different size and designed to supply a different quantity of air. March 5, 2013 – For the purpose of this rule, relocation of existing structures is considered a repair.

March 5, 2013 – Replacement of the central air handler, even if it is a different design, is a repair when all work is in the mechanical room.

New Construction:

March 5, 2013 – New construction of a new building or wing. Individual classrooms may be added on, and tap into existing HVAC systems that were already sized to accommodate additional rooms. If the HVAC has to be upgraded to accommodate the additional rooms this may have to be reviewed on an individual basis.

Chemicals

Chemicals:
Every day you use chemicals at school and on school grounds. Not all chemicals are serious health threats, but some are. Good health is important to our families, the students in our schools, and to us. Therefore, you and your co-workers need to know what dangers are associated with the chemicals you use. The primary focus of this chapter is to protect students and employee health by enabling schools to store products effectively to minimize adverse health and environmental effects. Even more so than adults, children can be vulnerable to, and may be severely affected by, exposure to chemicals, hazardous wastes, and other environmental hazards.

Due to the wide variety of activities that occur in a school building, many different chemicals are used in a variety of ways. From cleaning and maintenance to science labs to art classes to turf management and more, hazardous chemicals are used throughout the facility and stored in various locations. Proper management of these chemicals can sometimes be overlooked and lead to unnecessary hazards. Therefore, it is important school officials know about the chemicals used on site and the regulations affecting them.

Remember, chemical management (or mismanagement) will affect safety, health, indoor air quality, drinking water quality, storm water quality, and you!

To comply with Indiana law, schools must adopt and enforce a policy that minimizes student and staff exposure to chemicals. A sample policy is enclosed.

To be effective, this policy should include the following:

1. A hazardous chemical inventory of what chemicals are used, by who, where those chemicals are used, where they are stored, and what needs to be disposed of.

2. Establish a chemical purchasing policy that requires protocol for how chemicals are approved for purchase and ensures material safety data sheets (MSDS) are maintained and indicates locations where MSDS are stored. Consider centralizing purchasing and inventory. Efforts are taken to reduce over purchasing and stockpiling. Also, ensures that "forbidden" chemicals are not purchased or used at the school (i.e., mercury, or products that contain mercury). Determine which chemicals have risks that outweigh the educational need.

3. Establishes requirements for proper use of hazardous chemicals including installing proper ventilation to limit exposure to staff and students.

4. Establishes requirements for storage including ventilation, compatible storage cabinets (i.e., nonmetal cabinets for storing corrosive chemicals), locking, and labeling.

5. A plan and budget for proper disposal of unused, outdated, or hazardous chemicals.

6. Plan for spills, explosions, and accidental exposure to hazardous chemicals.

A variety of free resources are available to schools to improve chemical management. These resources include:

- EPA's Chemical Management Resource Guide for School Administrators - http://www.epa.gov/oppt/pubs/chemmgmt/resourceguide.pdf
- Indiana's GreenSteps for Schools - https://www.in.gov/idem/health/2335.htm
- IDEM's Website on School Lab Cleanouts - https://www.in.gov/idem/health/2329.htm
- EPA, Healthy School Environments - http://www.epa.gov/schools/
- School Chemistry Laboratory Safety Guide - Consumer Product Safety Commission, www.cpsc.gov,
- Chemical Management in Schools (Michigan DEQ) contains sample checklists, chemicals spreadsheets, lists, etc.- http://www.michigan.gov/documents/deq/deq-oppca-notebook-chemicalmanagement_293287_7.pdf
- Council of State Science Supervisors - Making the Connection Science Safety: It's Elementary – https://portal.ct.gov/-/media/SDE/Science/Safety/scisaf_cal.pdf
- Rehab the Lab, Safe labs that don't pollute - https://www.hazwastehelp.org/educators/rehabthelab.aspx
- EPA's Mercury Web Site -www.epa.gov/mercury
- ATSDR Mercury in Your Schools - https://www.atsdr.cdc.gov/dontmesswithmercury/mercury_school.html

IAC – 33-4-8 States:

Sec. 8. (a) Student exposure to chemicals must be kept to a minimum. When evaluating student exposures, the more stringent of National Institute for Occupational Safety and Health (NIOSH) limits or Occupational Safety & Health Administration (OSHA) limits must be used.

(b) Where chemicals are used during class, such as, but not limited to, chemistry, biology, and shop classes, appropriate ventilation must be used to minimize students' exposure to these chemicals such as a local exhaust system.

(c) The school shall adopt and enforce a policy that minimizes student and staff exposure to chemicals.

The following list covers several of the types of chemicals students may be exposed to in schools. This list is not all inclusive but will provide the school corporations a starting point when developing their policy.

(1) Chemicals used in the classroom such as white board markers and cleaners
(2) Bactericides.
(3) Disinfectants such as bleach.
(4) Germicides.
(5) Sanitizing agents. such as countertop cleaners or hand sanitizers
(6) Swimming pool chemicals.
(7) Water purifying chemicals
(8) Pesticides – See "Pesticide Use at Schools" 357 IAC 1-16

Example Chemical Selection and Use Policy.

Suggested Chemical Management Policy

A. Purpose:
The purpose of this policy is to reduce student and staff exposure to chemical hazards from hazardous chemicals used or kept at the school. By selecting products with lesser hazards, and by properly using these products, there will be a reduced risk of exposure to these products.

B. Applicability:
This policy applies to all chemicals purchased for use in child occupied school buildings.

C. Steps:

1. **Inventory**
    a) Each year, the school corporation conducts a site-wide chemical inventory. During the inventory, expired and unwanted chemicals are identified for proper disposal. Compliance with this policy is reviewed.

2. **Purchasing**

a) Chemical purchases shall adhere to the following protocol:

1) This school has identified the following procedures and guidelines for purchasing chemicals in an effort to minimize student and staff exposure to chemical hazards:
    i. Please describe how staff may purchase chemicals (i.e. is there a central person who approves purchases or does each department make the decision, etc.).
    ii. Donated items such as hand sanitizers and any products staff want to bring into the school must be approved by school administration.
        a. First in first out policy is followed. (over purchasing and stock piling are not permitted.)
        b. The least toxic chemical that is still effective for the job is selected. (Material Safety Data Sheets are reviewed to make this determination). This includes selection of cleaning supplies as well as teaching tools for classrooms. Micro and green chemistry are encouraged.
        c. This school will not purchase chemicals listed on the Banned Chemical List. (**School** – Please determine which chemicals you will not use. i.e. Mercury or mercury containing products; consider lists of chemicals that may be too hazardous)

b) Material Safety Data Sheets (MSDS)will be available at __________(**School** – Determine where these will be kept; consider 2 locations: a central location and with the chemical) The MSDS books are updated annually and as new chemicals are purchased.

3. Use

a) Chemicals will be mixed and used according to manufacturer's directions. Measuring devices or direct mixing systems are to be used. Any warnings, especially requirements for ventilation are to be followed.
b) When possible, use of cleaning products should be performed when students are not present.
c) Areas where chemicals are being used will be properly ventilated.
d) Only properly trained staff may use hazardous chemicals. Staff will receive annual training and when required, certification (i.e., pesticide applicators).
e) Required notification procedures will be followed (i.e., pesticide notifications)

4. Storage

a) Secondary containers will not be used to store chemicals unless they are properly labeled and approved for such use.
b) Storage areas will be properly ventilated.
c) Storage areas will be compatible with the chemicals being stored in them.
d) Reactive chemicals will not be stored near each other.
e) Hazardous chemicals will be stored in locked areas at all times.
f) All original containers will be labeled with the date received

5. **Disposal**
   a) Unwanted, unused, and outdated chemicals should be identified as soon as
   possible, and no less than annually. They should be marked for disposal.
   b) Disposal will follow state regulations. Pouring down the drain or throwing in the trash is not acceptable or proper disposal in most instances.
   c) The school has a budget for proper disposal of hazardous waste.

6. **Spills, Explosions, and Accidents (including inhalation, ingestion, or direct contact)**
   a) **School** – Outline steps staff should take in the event of one of these emergencies and include contact numbers
   b) Call 911
   c) Call Indiana Poison Center at 1-800-222-1222

Pesticides

Pesticide application in schools is regulated by the Indiana Pesticide Review Board. To review the rule, see: 357 IAC 1-16.

Schools should use integrated pest management to minimize pesticide use while still controlling pests. Below is a portion of EPA's information on IPM taken from their website.

Integrated Pest Management (IPM) is a safer and usually less costly option for effective pest management in the school community then traditional, routine pesticide use. A school IPM program employs commonsense strategies to reduce sources of food, water and shelter for pests in your school buildings and grounds. IPM programs take advantage of all pest management strategies, including judicious careful use of pesticides when necessary.

How Do You Know if Your School is Really Using IPM?

You can make sure that:

1. The problem or pest is identified before taking action.
2. Vegetation, shrubs and wood mulch should be kept at least one foot away from structures.
3. Cracks and crevices in walls, floors and pavement are either sealed or eliminated.
4. Lockers and desks are emptied and thoroughly cleaned at least twice yearly.
5. Food-contaminated dishes, utensils, surfaces are cleaned by the end of each day.
6. Garbage cans and dumpsters are cleaned regularly.
7. Litter is collected and disposed of properly at least once a week.
8. Fertilizers should be applied several times (e.g., spring, summer, and fall) during the year, rather than one heavy application.
9. If pesticides are necessary, use spot treatments rather than area-wide applications.
10. When selecting products, select the most environmentally friendly product that will meet your needs.

It is recommended that any food stored in classrooms or lounges be kept in sealed storage containers.

For more information we suggest you look at the **Indiana State Chemist's webpage regarding pesticide use at schools:**
https://www.oisc.purdue.edu/pesticide/pest_use_at_school.html

Indiana Mercury Spill Information and Cleanup Guidance for Schools

Background Information

Although, mercury performs many useful functions, it is toxic to humans and wildlife and should be managed properly. When liquid (elemental) mercury is spilled, it forms beads or droplets that can accumulate in the tiniest places. These droplets can emit vapors into the air that we cannot see or smell. Breathing mercury vapors can be very dangerous, depending on how much mercury is in the air and how long you breathe the contaminated air. Entire families have been poisoned from mercury spills. Small children and pregnant women are at highest risk for mercury poisoning, but mercury poisoning can impact anyone.

In Indiana, for mercury spills larger than a pea, call the IDEM Spill Hotline at (888) 233-7745.

Outside Indiana, call your local or state health or environmental agency or the National Response Center at (800) 424-8802.

Law bans mercury in schools

The Indiana Legislature passed a law in 2003 banning mercury and mercury-containing instructional equipment (unless there is no mercury-free substitute) and materials from Indiana schools. For this reason, there should be no mercury or mercury instruments in your school and every effort should be made to ensure that staff and students do not bring such items into your school. Read the law language.

Where was mercury formerly found in schools?

Although, in most instances, Indiana law prohibits it, there still may be mercury compounds and mercury-containing equipment in your school. Here are some locations where mercury has been commonly found in schools:

Chemistry and biology labs: Because of its physical properties, mercury had been a component of a variety of laboratory equipment (e.g., thermometers, barometers, psychrometers). In addition, mercuric compounds (e.g., mercuric chloride, calomel) were used in chemistry experiments.

School nurse’s station: Mercury-containing fever thermometers and blood pressure cuffs were used by school nurses. You may still have mercury-containing instruments in your nurse’s station.

Throughout the school: Mercury-containing thermostats, fluorescent light bulbs, and switches may be found in rooms throughout a school.

Brought into school: Occasionally, elemental mercury may be brought to school by students not realizing the hazards it may pose.

What to do when mercury is spilled in your school

The Indiana Department of Environmental Management (IDEM) recommends having a professional emergency contractor clean up mercury spills. If the spill is minor, such as one smaller than a pea, school or school district staff trained in hazardous materials spill cleanups may take on cleanup responsibilities.

> *Did you know…any total spill of more than a pea-sized bead of mercury is considered a large spill. A spill of this magnitude in a school should be considered very serious.*

Spill Response Action Steps for Liquid Mercury:

1. Designate two to three adults to evaluate the mercury spill.
2. Evaluate the spill. If the mercury was spilled on a heat source or if it was somehow vaporized or atomized (e.g., vacuumed), exposures can be severe. Consider evacuating the building. And if someone ingested mercury, call a poison center at 800-222-1222.
3. If the spill was larger than the size of a pea or if you think it may have been tracked into other rooms, contact the IDEM Spill Hotline immediately, (888) 233-7745 or (317) 233-7745 for technical assistance. The Spill Line is staffed 24 hours/day, 365 days/year. IDEM personnel will determine if IDEM and/or US EPA Region 5 from Chicago should be called in to perform a more thorough cleanup.
4. Determine if anyone involved in the spill has become contaminated with mercury on their clothes, shoes, or skin. Contaminated individuals should remain where they are to avoid spreading mercury to other areas. They will be decontaminated.
5. Everyone who is not contaminated or helping with the cleanup, including children and pets, should leave the area immediately. Be careful when evacuating – make sure no one walks through the mercury spill!
6. Immediately open the room’s outside windows and exterior doors to provide ventilation.
7. Close off the room from the rest of the building by closing all interior doors and windows. Close all cold air returns so that mercury vapor is not carried throughout the ventilation system. Turn off fans unless they vent to the outdoors. Use portable fans to blow mercury-contaminated air outdoors.

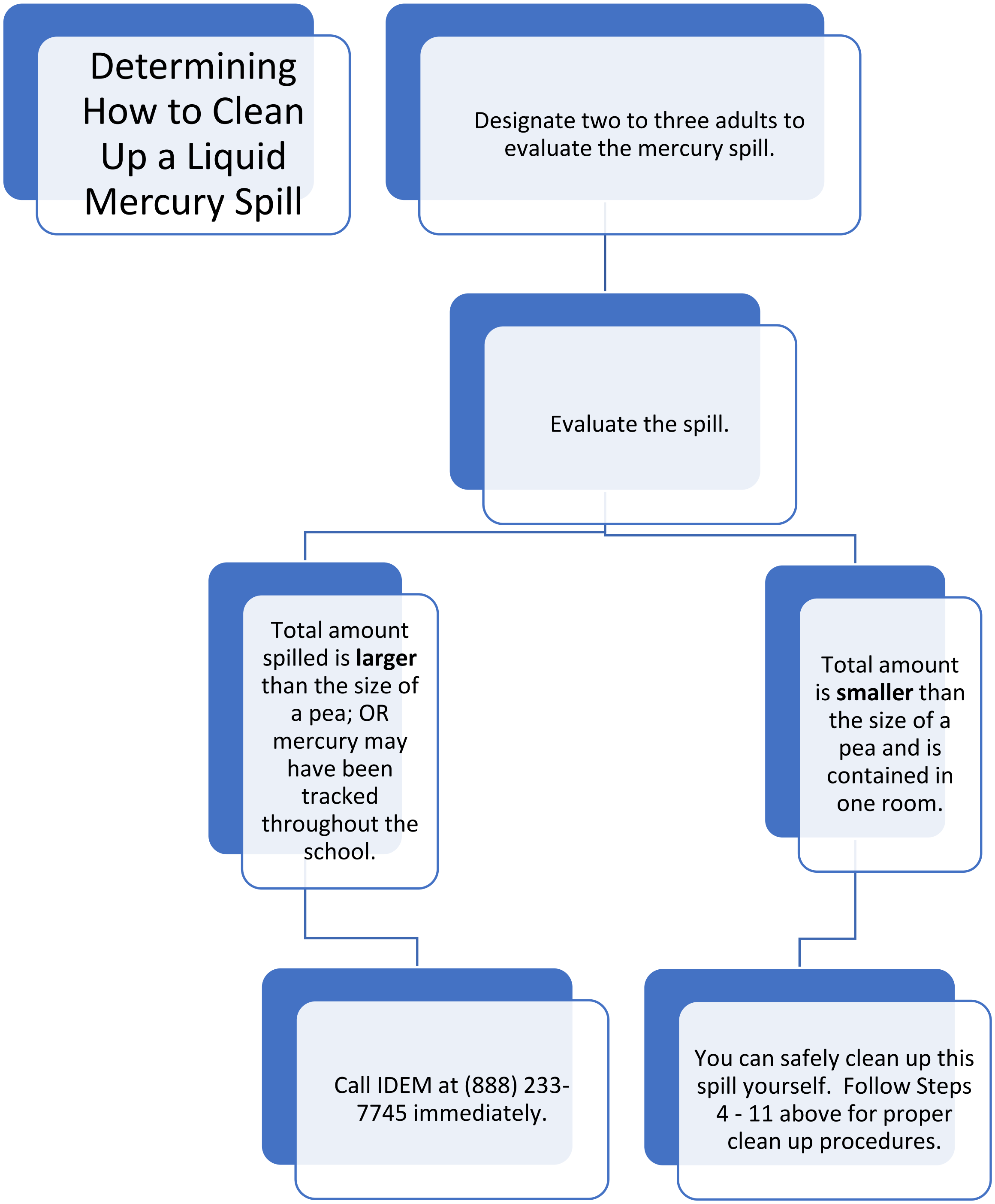
8. Anyone helping to decontaminate individuals or cleanup mercury should put on rubber or latex gloves.
9. Help the contaminated individuals remove contaminated clothing and/or shoes very carefully so as to avoid dislodging and spreading attached mercury. Place the contaminated clothing and/or shoes into a rigid container with a lid (or a trash bag may be used as a temporary container). Use the sticky side of a piece of duct tape to carefully remove any mercury that may be clinging to exposed skin. Use a new piece of strong tape (i.e., duct tape) for each area of exposed skin. Place the pieces of duct tape with adhered mercury into a sealable baggie and place it in the rigid container with the contaminated clothes. Used gloves should also be placed in the rigid container. Seal the container with the lid. Individuals should use clean clothes and shoes to replace their contaminated items. As soon as individuals are de-contaminated, they should evacuate the area, being careful not to walk through the mercury spill.
10. Turn off the ventilation and cooling systems to the spill area. If possible, all air ducts to the room should be closed temporarily. Contain any items contaminated with mercury in a rigid container or plastic trash bag. Seal the container with a lid. Take the mercury and other clean up materials such as used gloves to your local household hazardous waste program for recycling.

NOTES:

- NEVER use an ordinary vacuum or shop vacuum to clean up liquid mercury. Vacuuming
  mercury will blow vapors into the area, thereby increasing the likelihood of human exposure, and will also contaminate the vacuum cleaner. A contaminated vacuum cleaner should be taken to a mercury collection program.
- NEVER use a broom or a paintbrush to clean up mercury. It will break the mercury into smaller beads and further scatter the mercury.
- NEVER use household cleaning products, especially those containing chlorine or ammonia, because they may react violently with the mercury and release toxic gases.
- NEVER allow people whose shoes or clothing may be contaminated with mercury to walk around the school.
- NEVER put mercury in the trash.
- NEVER throw fluorescent or high-intensity discharge lamps in the garbage or trash. These bulbs contain mercury. Some schools are required by law to either properly recycle or manage lamps as hazardous waste.
- NEVER pour or allow mercury to go down a drain. Mercury becomes lodged in pipes, pollutes wastewater-treatment plants and makes its way to our lakes and streams. There it can contaminate fish and the animals and people who eat them.

- Any total spill of more than a pea-sized bead of mercury is considered a large spill. A spill of this magnitude in a school should be considered very serious. Call IDEM at (888) 233-7745 immediately.
- If the mercury spill is on a porous surface such as a carpet, or if the mercury droplets are widely dispersed in a room, call the IDEM Spill Hotline at (888) 233-7745 for assistance.

Most spills of elemental mercury have little potential to create health issues as long as the spill is properly cleaned up and mercury is not tracked to another location.



Cleaning up Broken Fluorescent Bulbs:

Fluorescent tubes, compact fluorescent lamps, and high-intensity discharge lights used for exterior lighting all contain a small amount of mercury vapors. These bulbs should be managed properly by recycling and by never changing bulbs when children are present in the same room. Placing these bulbs in the trash is not recommended and, in some instances, may be illegal. New and used fluorescent lamps, which contain mercury, may be stored in custodial areas. Fluorescent bulbs should be recycled whole and unbroken. Bulb-crushing machines are not recommended because they can emit large amounts of mercury into buildings and the environment.

When they break, they should be cleaned up in the following manner:

1. Clear the room of all students and staff.
2. If more than two bulbs were broken, call the IDEM Spill Hotline at (888) 233-7745 or (317) 233-7745 for clean up and disposal instructions. If two or fewer bulbs were broken, follow the steps below.
3. Open any outside windows, close all interior doors and windows, and leave the room for 15 minutes.
4. Wear rubber gloves and carefully pick up all glass shards and any remaining powder with duct tape or other sticky tape.
5. Wash the area with soapy water using disposable towels and dry the area with disposable towels.
6. If a bulb breaks on carpet, follow steps 1, 3, and 4. After all visible signs of the bulb have been removed from the carpet, you may vacuum the area.
7. Put all glass, tape, disposable towels and vacuum cleaner bag (or contents of a bagless vacuum) into a rigid container. Seal the container with a lid.
8. Air out the incident room for 12 to 24 hours.
9. Take the broken bulb and other clean up materials such as used gloves to your local household hazardous waste program for recycling.

More than 2 bulbs were broken

- Clear the room of all students and staff.
- Call the IDEM Spill Hotline at (888) 233-7745.

1 or 2 bulbs were broken

- Clear the room of all students and staff.
- You can safely clean up this spill yourself. Follow Steps 3 - 9 above for proper clean up procedures.

Why is spilled mercury a concern?

Mercury is a toxin that can affect the nervous system of humans. It can also damage the liver and kidneys. Even small amounts of spilled mercury may become a health hazard if it is not properly controlled and cleaned. Heating mercury or failing to clean up a spill can lead to a large exposure or long-term exposure to lower amounts of mercury. Both can impact your health.

The small amount of elemental mercury in fever thermometers and thermostats is not likely to cause serious health problems if it is immediately cleaned up. The mercury in a broken fluorescent light bulb is not readily visible, but broken bulbs should also be cleaned up immediately.

Elemental mercury vapor easily moves from the lungs to the bloodstream. Heating elemental mercury or breathing excessive amounts of vapor from a spill can be very harmful. Ingestion of liquid mercury does not typically result in health impacts because elemental mercury does not pass easily from the gastrointestinal system into the bloodstream. In addition, people usually can avoid swallowing mercury that has been spilled.

Most symptoms of mercury exposure are subtle and reversible upon removal of exposure. Symptoms of a large exposure to mercury may include pink skin, skin rashes or lesions, muscle tremors, personality and behavioral changes, memory loss, and damage to the kidneys and central nervous system.

The best advice: Keep mercury out of your school

Because there is a ban on the purchase and use of mercury in Indiana schools, you are bound by law to refrain from purchasing products and devices that contain mercury or mercury compounds, except fluorescent lamps.

Fortunately, mercury-free substitutes exist for just about everything that would be used in a school:

- alcohol (red bulb) and isoamyl benzoate (blue bulb) and digital lab and fever thermometers,
- electronic thermostats and switches,
- aneroid blood-pressure units, and
- digital barometers and other gauges.

Need more help?

Technical Assistance when cleaning up a spill: The Spill Hotline can be reached any time at (888) 233-7745 or (317) 233-7745.

School Chemical Cleanout: School districts that wish to conduct a Chemical Cleanout may obtain health and safety information online.

Hazardous waste information: You can obtain confidential assistance with proper disposal of hazardous waste by calling IDEM's Compliance and Technical Assistance Program at (800) 988-7901.

Health-related questions: Questions about the health impacts of mercury can be obtained by contacting the Indiana State Department of Health (ISDH) Office of Indoor and Radiological Health at (317) 351-7190, ext. 253 or the Indiana Poison Center at (800) 222-1222. The Poison Center line is staffed 24 hours/day, 365 days/year.

Sources:

Indiana Department of Environmental Management "Mercury Spill Information and Cleanup Guidance"

Minnesota Pollution Control Agency "Cleaning Up a Mercury Spill in Your School"

U.S. Environmental Protection Agency "Mercury and Hazardous Chemicals in Schools: A Manual for Students in Southeast Asia"

U.S. Environmental Protection Agency "Healthy School Environments: Mercury Website"

Provided by the Indiana Department of Environmental Management (IDEM)

Indoor Swimming Pool Irritants

According to the Center for Disease Control, irritants in the air at indoor swimming pools are usually the combined chlorine by-products of disinfection. These by-products are the result of chlorine binding with sweat, urine, and other waste from swimmers.

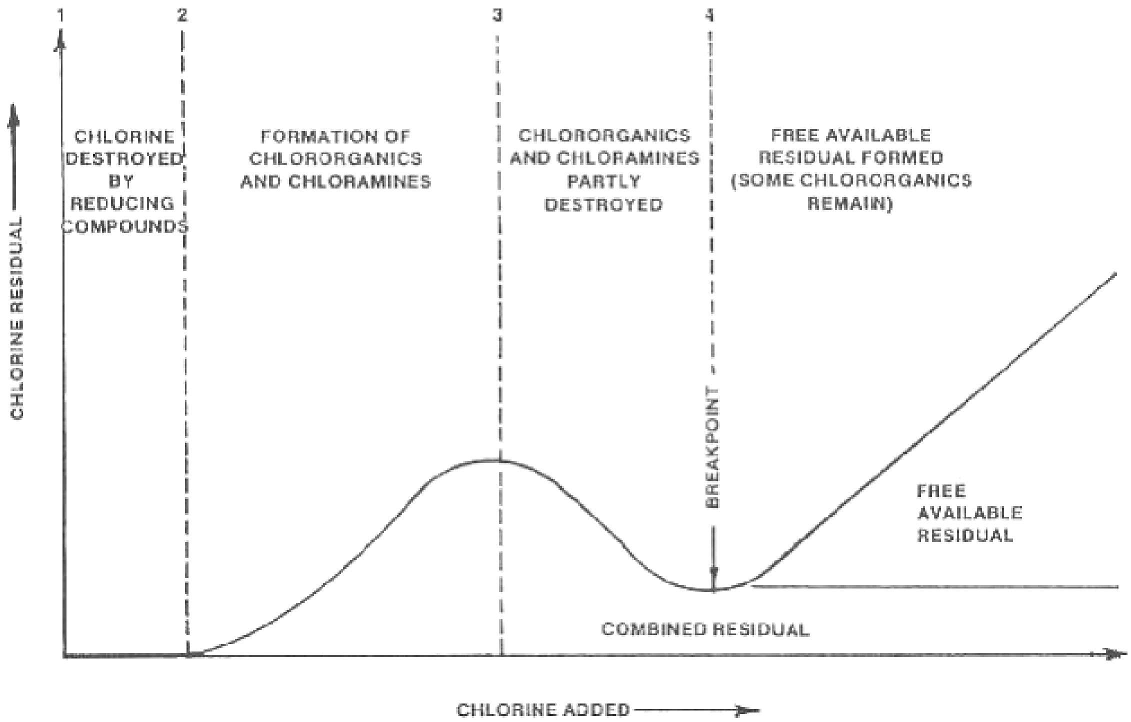
A multi-faceted approach to address this issue is the best way to minimize these contaminants.

1. Insisting swimmers shower prior to entering the pool will reduce the nitrogen products that are instrumental in creating the chloramines. The facility is required to have signage requiring showering as specified in 410 IAC 6-2 Sec. 36 (b) (3)
2. Educate swimmers, teachers, and coaches on the causes of the chloramines, and steps they can take to reduce the chloramine production so the air they breathe will be healthier.
3. Ensuring fresh air supply and exhaust in the pool area meets or exceeds the ASHRAE 62.1 ventilation standard found in ASHRAE 62.1, Table 6-1.
4. Properly maintaining the pool chemistry to minimize the chloramine production in the water is a key step in minimizing airborne chloramines. A low pH in the pool water has been found to contribute to chloramine production in indoor pool facilities.

Chloramines (combined chlorine) depending on the stage in the chemical reaction are monochloramine, dichloramine and trichloramine. The chloramines, especially the trichloramines, are irritating to the eyes, nose and lungs. Trichloramines cause the "chlorine" smell and hang in the air directly above the pool water level, often causing competitive or frequent swimmers to have asthma like symptoms. High levels of chloramines will also cause corrosion to surfaces and equipment in the pool area.

Chloramines can usually be eliminated from the pool water by performing breakpoint chlorination with chlorine or superoxidation with a non chlorine oxidizer. Indiana Department of Health Swimming Pool Rule 410 IAC 6-2.1, Section 30(e) states: "The pool water shall be superchlorinated to breakpoint or superoxidized with a nonchlorine oxidizer, when the pool test kit reveals a combined chlorine (chloramine) concentration of five-tenths (0.5) parts per million (ppm) or greater." 410 IAC 6-2.1, Sec. 30 (g) states: "The pool shall be closed and remain closed during breakpoint chlorination until the chlorine concentration drops to the maximum level referenced in subsection (b)."

Breakpoint chlorination is the point at which enough free chlorine is added to break the molecular bonds, specifically the combined chlorine molecules, ammonia or nitrogen compounds. It takes a ratio of chlorine to ammonia atoms of 7.6 to 1 to reach breakpoint, other contaminants (i.e., bacteria, algae) are also present that must be oxidized, so 10 times the amount of combined chlorine must be added. Any excess chlorine leftover will become the chlorine residual (FC).



To reach breakpoint, the following calculation is used:

Example: Calculate the chemical change to achieve Breakpoint Chlorination in 60,000-gallon pool with FC of 1.5 ppm and TC of 2.3 ppm. Using 67% Calcium Hypochlorite where the label states that 2 oz will produce a chemical change of 1ppm in 10,000 gallons of water:

STEP 1: Determine the amount of Combined Chlorine (CC)

Total Chlorine (TC) – Free Chlorine (FC) = Combined Chlorine (CC)

2.3 ppm – 1.5 ppm = **0.8 ppm**

STEP 2: Calculate the breakpoint Chlorination (BPC) amount

Breakpoint (BPC) = CC × 10

0.8 × 10 = 8.0 ppm

STEP 3: Determine the desired change amount

Desired Change = BPC – FC

8.0 ppm – 1.5 ppm = **6.5 ppm**

STEP 3: Determine the amount of chemical to add:

Amount of chemical from product label	**Actual Pool Volume**	**Desired Chemical Change**	**Total**
	60,000	6.5	
	÷ 10,000 from product label	÷ 1.0 ppm from product label	
2 oz.	× 6	× 6.5	78 oz

Convert answer to pounds: 78 ÷ 16 = 4.875 lbs; rounded to 5 pounds.

Steps 1 must be done using a DPD test, using the test kit instructions.

- Sodium hypochlorite (liquid) or lithium hypochlorite may also be used.
- Calcium hypochlorite is most commonly used because of the high available chlorine concentration and it retains its strength in storage.
- NOTE: When shocking a pool, the chlorine-based chemical used for shocking the water must be added all at once so that the concentration throughout the pool reaches breakpoint chlorination.

This is an "all or nothing" process. Not adding enough chlorine to reach breakpoint will make the problem even worse as the result is the formation of more chloramines and re-dissolving of chloramines back into the pool water. Continual "shocking" but not reaching breakpoint will result in the pool reaching a point of no return. Partial or complete draining of the pool water and refilling with fresh water may be the only remedy at this point. If an indoor pool facility has inadequate air exchange with outdoor fresh air, it will be necessary to add air circulation fans with doors and windows open to keep the air above the pool water level moving to prevent re-dissolving of nitrogen (by product of breakpoint chlorination) leading to more chloramine formation.

Please note that adding too much chlorine, beyond breakpoint, will yield high chlorine residual that may require the pool to remain closed until the free chlorine residual drops to an acceptable level as required in 410 IAC 6-2.1, Sec. 30(b).

Additionally, 410 IAC 6-2.1, Sec. 30 (k) states: "Chlorinated isocyanurates and cyanuric acid stabilizers shall not be used in any indoor pool." Stabilized chlorine compounds, such as DICHLOR or TRICHLOR may **not** be used for breakpoint chlorination or continuous chlorination in an indoor pool.

NON-CHLORINE OXIDIZERS

Non-chlorine oxidizers may be used instead of chlorine breakpoint chlorination, but the pool will still have to be superchlorinated periodically with a chlorine compound to kill off the bacteria that become resistant to constant exposure to low levels of disinfectant (chlorine or bromine). Non-chlorine oxidizer products will oxidize or destroy ammonia, nitrogen and some swimmer waste, but will not kill bacteria or algae.

Although an advertised advantage to using a non-chlorine oxidizer is the shut down time may be as little as one half-hour; however, 410 IAC 6-2.1-30(s) requires that "The pool shall be closed for a period equal to at least one (1) hour following the manual addition of chemicals."

If the manufacturer's label requires closure for more than one hour, then 410 IAC 6-2.1-30(h) states that "… the pool shall be closed and shall remain closed in accordance with the specifications on the product label."

Potassium monopersulfate is the ingredient used in most non-chlorine oxidizers. As an oxidizer, it reacts with contaminants and prevents combined chlorine from forming (short term). The use of potassium monopersulfate will result in false readings of chlorine for up to 6 hours as it oxidizes the iodide in the reagent as if it were combined chlorine. There is a reagent available to correct this.

The use of non-chlorine shock chemicals will also interfere with oxidation reduction potential (ORP) readings because it measures the oxidizing potential of the water. These products are an oxidizer causing high ORP readings, but again it is not a disinfectant. In the end, the required free chlorine residual level for disinfection in the pool water may be below the required level as stated in 410 IAC 6-2.1.

Other options:

1. Adding a medium pressure UV (ultraviolet) light or ozone system to eliminate chloramines in the pool water. Many large indoor pools used for competition (i.e., colleges and high schools) have had success with using UV. Please note that either system can only be permitted as supplemental disinfection to chlorine disinfection in the State of Indiana.

   In addition to the disinfection of bacteria and viruses, UV-C will oxidize chloramines. UV-C that is used for chloramine destruction in indoor pools and spas must be polychromatic that produces wavelengths of 200-350 nanometers with a minimum dosage (fluence) of 600 J/m^2 (60 mJ/cm^2). Multiple wavelengths are necessary to destroy chloramines as listed below:

Monchloramine	245 nanometers
Dichloramine	297 nanometers
Trichloramine	260 and 340 nanometers

2. Some municipal water companies are using chloramines for additional disinfection in the distribution system, so there may be significant background levels in the pool supply water. In this case, carbon filters may be an option to reduce the chloramines in the source water.
3. Increasing the amount of fresh water added daily to the pool.
4. For spas, it may be best to drain and refill with fresh water more often. Recommended drain and refill calculation is:

   Spa gallons ÷ 3 ÷ users per day = replacement interval (days)

The science behind the chloramine production is evolving and as science adds to the knowledge, this document will be changed, as appropriate, to reflect those improvements. For the most up to date information on chloramines in indoor swimming pools see the Environmental Public Health Division's swimming pool web page at www.pools.isdh.in.gov.

Resources:

- www.in.gov/isdh/files/How_To_Shock_The_Pool.pdf

- www.cdc.gov/healthywater/swimming/pools/irritants-indoor-pool-air-quality.html
- https://www.health.nsw.gov.au/environment/factsheets/Pages/breakpoint-chlorination.aspx

HOW TO SHOCK THE POOL
(CHLORINATE TO BREAKPOINT)

Chloramines / Combined Chlorine

If you smell "chlorine", coming from your pool, what you really smell are combined forms of chlorine, also called chloramines. Chloramines are chemical compounds formed by chlorine combining with nitrogen containing contaminates in the pool water. These are still disinfectants, but they are 40 to 60 times less effective than free available chlorine. Contaminates come from swimmer wastes such as sweat, urine, body oil, etc. Therefore, requiring all bathers to take a warm, soapy water shower is a good idea.

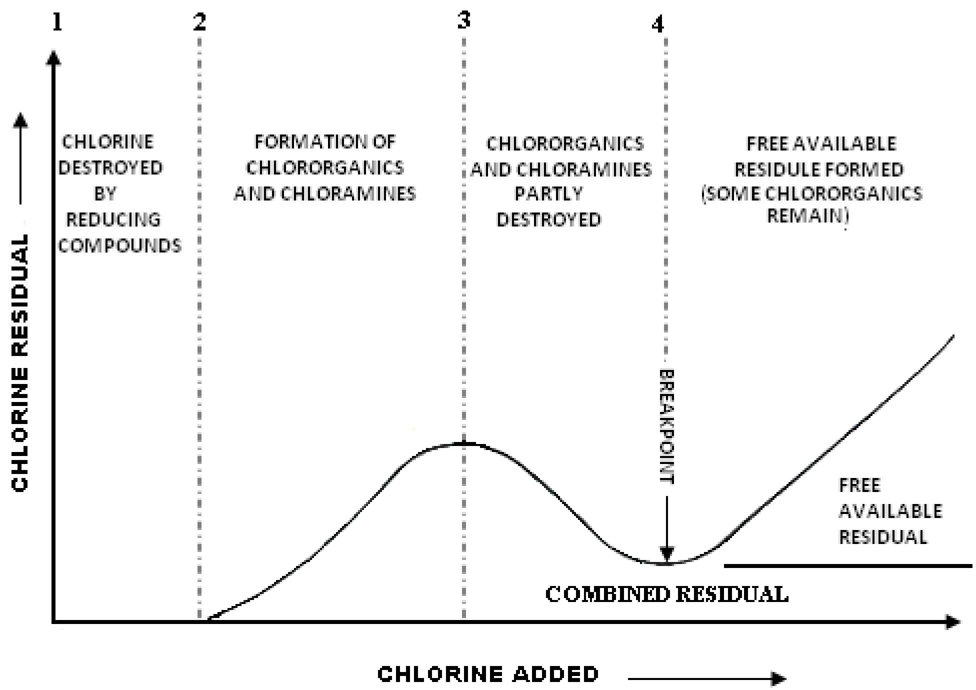
Three types of chloramines can be formed in water - monochloramine, dichloramine, and trichloramine. Monochloramine is formed from the reaction of hypochlorous acid with ammonia. Monochloramine may then react with more hypochlorous acid to form a dichloramine. Finally, the dichloramine may react with hypochlorous acid to form a trichloramine. Trichloramines cause the "chlorine" smell and hang in the air directly above the pool water level, often causing competitive or frequent swimmers to have asthma like symptoms. High levels of chloramines will also cause corrosion to surfaces and equipment in the pool area. The trichloramines are especially irritating to the eyes, nose and lungs.

Chloramines can usually be eliminated from the pool water by performing breakpoint chlorination with chlorine or super oxidation with a non-chlorine oxidizer. Ultraviolet systems and ozone systems are effective at reducing chloramines in pools.

Breakpoint chlorination

Break point chlorination is adding enough chlorine to eliminate problems associated with combined chlorine. Specifically, breakpoint chlorination is the point at which enough free chlorine is added to break the molecular bonds, specifically the combined chlorine molecules, ammonia or nitrogen compounds. It takes a ratio of chlorine to ammonia atoms of 7.6 to 1 to reach breakpoint, other contaminants (i.e., bacteria, algae) are also present that must be oxidized, so 10 times the amount of combined chlorine must be added. When sufficient free chlorine (FC) is added to pool water, the inorganic chloramines are converted to dichloramine, then to nitrogen trichloride, and then to nitrogen gas. Any excess chlorine leftover will become the chlorine residual (FC).

The graph below shows what happens when chlorine (either chlorine gas or a hypochlorite) is added to water. First (between points 1 and 2), the water reacts with reducing compounds in the water, such as hydrogen sulfide. These compounds use up the chlorine, producing no chlorine residual.



Between points 2 and 3, the chlorine reacts with organics and ammonia naturally found in the water. Some combined chlorine residual is formed – chloramines.

Between points 3 and 4, the chlorine will break down most of the chloramines in the water, actually lowering the chlorine residual.

Finally, the water reaches the breakpoint, shown at point 4. The breakpoint is the point at which the chlorine demand has been totally satisfied - the chlorine has reacted with all reducing agents, organics, and ammonia in the water. When more chlorine is added past the breakpoint, the chlorine reacts with water and forms hypochlorous acid in direct proportion to the amount of chlorine added.

The combined chlorine (CC) level is calculated by subtracting the free chlorine (FC) from the total chlorine (TC) in the pool/spa water. Rule 410 IAC 6-2.1-30(o) 2 requires testing of the pool/spa water for combined levels at least twice a week.

Rule 410 IAC 6-2.1-30(e) requires "The pool water shall be superchlorinated to breakpoint or superoxidized with a nonchlorine oxidizer, when the pool test kit reveals a combined chlorine (chloramine) concentration of five-tenths (0.5) parts per million (ppm) or greater." However, studies have shown that swimmers find pool water the most enjoyable if more than 85% of the total chlorine is free chlorine. Therefore, the Environmental Public Health Staff recommends superchlorination when the combined chlorine concentration is 0.2 ppm or greater (a total chlorine of 1.2 ppm and a free chlorine of 1.0 ppm provides 83% of total chlorine as free chlorine).

Note: Pools using bromine as a sanitizer must also perform breakpoint superchlorination using chlorine. Like chlorine, bromine combines with organic impurities to form combined bromine and bromamines.

For a more complete discussion of breakpoint chlorination see the North South Wales, Australia health website:
https://www.health.nsw.gov.au/environment/factsheets/Pages/breakpoint-chlorination.aspx or the addendum to this document.

Achieving Breakpoint Chlorination

To achieve the breakpoint, the free chlorine (FC) added to the water must be about ten times the amount of combined chlorine (CC). This is an "all or nothing" process. Not adding enough chlorine to reach breakpoint will make the problem even worse as the result is the formation of more chloramines and re-dissolving of chloramines back into the pool water. Continual "shocking" but not reaching breakpoint will result in the pool reaching a point of no return. Partial or complete draining of the pool water and refilling with fresh water may be the only remedy at this point. If an indoor pool facility has inadequate air exchange with outdoor fresh air, it will be necessary to add air circulation fans with doors and windows open to keep the air above the pool water level moving to prevent re-dissolving of nitrogen (by product of breakpoint chlorination) leading to more chloramine formation.

Please note as required in 410 IAC 6-2.1, Sec. 30 (g) "The pool shall be closed and remain closed during breakpoint chlorination" and adding too much chlorine, beyond breakpoint, will yield high chlorine residual that may require the pool to remain closed until the free chlorine residual drops to an acceptable level as required in 410 IAC 6-2.1, Sec. 30 (b).

Calculating Amount of Chemical to Achieve Breakpoint Chlorination

The DPD test does not measure combined chlorine (CC) directly, it measures free chlorine (FC) in Step 1 and total chlorine (TC) in Step 2. Total Chlorine is the sum of free chlorine and combined chlorine. Therefore, combined chlorine is the difference between total chlorine and free chlorine. CC = TC – FC.

The first step in determining the necessity of a shock treatment is to determine the level of combined chlorine.

Using the D.P.D. testing kit, test for free chlorine (FC) and total chlorine (TC). After completing the water test, you subtract the free chlorine reading from the total available chlorine reading, the result indicates the combined chlorine (CC) or chloramine level in the pool water.
For example:
Combined Chlorine = Total Chlorine - Free Chlorine
2.3 ppm (TC) measured from test kit - 1.5 ppm (FC) measured from test kit = 0.8 ppm CC.

If the water has no chloramines, the answer to the subtraction will be zero (0) and a shock treatment is not needed. This is a desirable level. After determining the level of combined chlorine in the pool water, the pool operator must determine the breakpoint chlorination for that value.

The breakpoint chlorination value is 10 times the combined chlorine (CC) level.
For example: 0.8 ppm (CC) from the above example × 10 = 8 ppm of chlorine to achieve breakpoint.
Taking into account the free chlorine already in the pool, chlorine will have to be added to the level of 8 ppm.

Determine the Amount of chemical to add*:

Example**: Calculate the chemical change to achieve Breakpoint Chlorination in 60,000-gallon pool with FC of 1.5 ppm and TC of 2.3 ppm. Using 67% Calcium Hypochlorite where the label states that 2 oz will produce a chemical change of 1ppm in 10,000 gallons of water:

STEP 1: Determine the amount of Combined Chlorine (CC)

Total Chlorine (TC) – Free Chlorine (FC) = Combined Chlorine (CC)

2.3 ppm – 1.5 ppm = **0.8 ppm**

STEP 2: Calculate the breakpoint Chlorination (BPC) amount

Breakpoint (BPC) = CC × 10

0.8 × 10 = **8.0 ppm**

STEP 3: Determine the desired change amount

Desired Change = BPC – FC

8.0 ppm – 1.5 ppm = **6.5 ppm**

STEP 3: Determine the amount of chemical to add:

Amount of chemical from product label	**Actual Pool Volume**	**Desired Chemical Change**	**Total**
	60,000	6.5	
	÷ 10,000 from product label	÷ 1.0 ppm from product label	
2 oz.	× 6	× 6.5	78 oz

Convert answer to pounds: 78 ÷ 16 = 4.875 lbs.; rounded to 5 pounds.

Steps 1 must be done using a DPD test, using the test kit instructions.

*For an alternate and somewhat simpler method for calculating chemical amounts for breakpoint chlorination see the addendum to this document.

**For additional information on calculating chemical amounts to add to pools see: www.in.gov/isdh/files/Chemical_adjustment_pool.pdf

Stabilized chlorine compounds, such as DICHLOR or TRICHLOR may not be used for "shocking" because the permitted level of cyanuric acid would be exceeded over the season. It also would cause the water to have elevated chlorine levels for days.

NON-CHLORINE OXIDIZERS

Non-chlorine oxidizers may be used instead of chlorine breakpoint chlorination, but the pool will still have to be superchlorinated periodically with a chlorine compound to kill off the bacteria that become resistant to constant exposure to low levels of disinfectant (chlorine or bromine). Non-chlorine oxidizer products will oxidize or destroy ammonia, nitrogen and some swimmer waste, but will not kill bacteria or algae.

Although an advertised advantage to using a non-chlorine oxidizer is the shut down time may be as little as one half-hour; 410 IAC 6-2.1-30(s) requires that "The pool shall be closed for a period equal to at least one (1) hour following the manual addition of chemicals."

If the manufacturer's label requires closure for more than one hour, then 410 IAC 6-2.1-30(h) states that "… the pool shall be closed and shall remain closed in accordance with the specifications on the product label."

Potassium monopersulfate is the ingredient used in most non-chlorine oxidizers. As an oxidizer, it reacts with contaminants and prevents combined chlorine from forming (short term). The use of potassium monopersulfate will result in false readings of chlorine for up to 6 hours as it oxidizes the iodide in the reagent as if it were combined chlorine. There is a reagent available to correct this.

The use of non-chlorine shock chemicals will also interfere with oxidation reduction potential (ORP) readings because it measures the oxidizing potential of the water. These products are an oxidizer causing high ORP readings, but again it is not a disinfectant. In the end, the required free chlorine residual level for disinfection in the pool water may be below the required level as stated in 410 IAC 6-2.1.

Other options:

1. Adding a medium pressure UV (ultraviolet) light or ozone system to eliminate chloramines in the pool water. Many large indoor pools used for competition (i.e. colleges and high schools) have had success with using UV. Please note, in the State of Indiana, either system can only be permitted as supplemental disinfection to chlorine disinfection.

2. In addition to the disinfection of bacteria and viruses, UV-C will oxidize chloramines. UV-C that is used for chloramine destruction in indoor pools and spas must be polychromatic that produces wavelengths of 200-350 nanometers

with a minimum dosage (fluence) of 600 J/m2 (60 mJ/cm2). Multiple wavelengths are necessary to destroy chloramines as listed below:

Monchloramine	245 nanometers
Dichloramine	297 nanometers
Trichloramine	260 and 340 nanometers

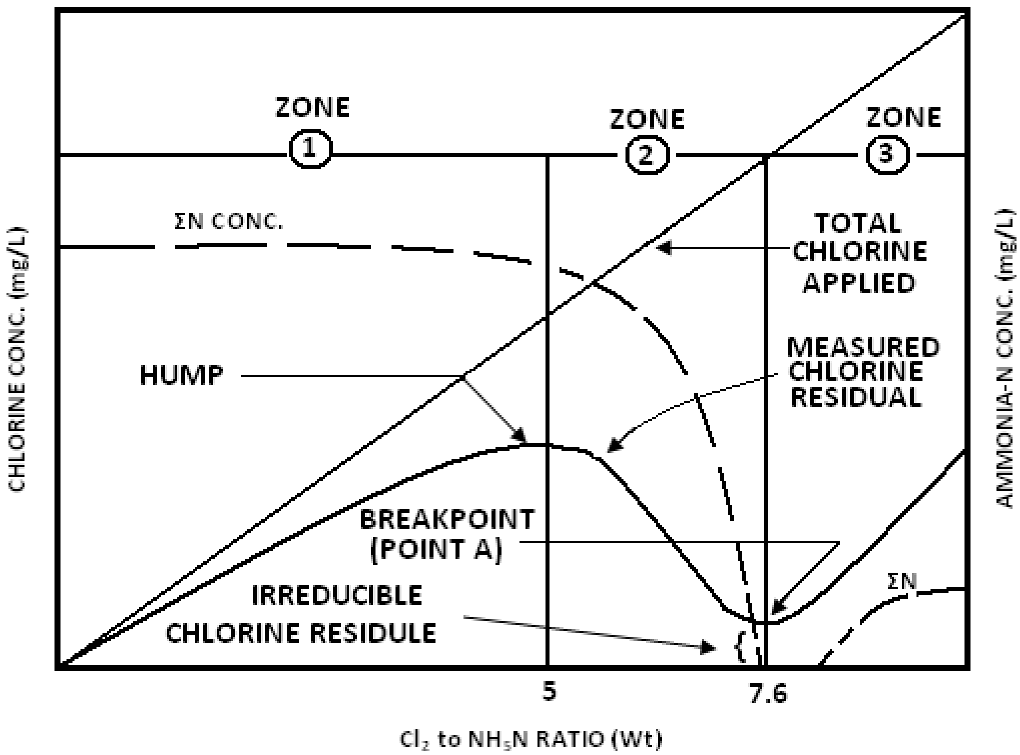
3. Some municipal water companies are using chloramines for additional disinfection in the distribution system, so there may be significant background levels in the pool supply water. In this case, carbon filters may be an option to reduce the chloramines in the source water.
4. Increasing the amount of fresh water added daily to the pool.
5. For spas, it may be best to drain and refill with fresh water more often. Recommended drain and refill calculation is: Spa gallons ÷ 3 ÷ users per day = replacement interval (days).

The science behind the chloramine production is evolving and as science adds to the knowledge, this document will be changed, as appropriate, to reflect those improvements. For the most up to date information on chloramines in indoor swimming pools see the Environmental Public Health Division's swimming pool web page at www.pools.isdh.in.gov.

Resources:
www.cdc.gov/healthywater/swimming/pools/irritants-indoor-pool-air-quality.html
https://www.health.nsw.gov.au/environment/factsheets/Pages/breakpoint-chlorination.aspx
www.in.gov/isdh/files/Chemical_adjustment_pool.pdf

Addendum

,Breakpoint Chlorination*
Graphical Representation of Breakpoint Chlorination



The above graph demonstrates the theory of continuous breakpoint chlorination. On the left vertical axis is the chlorine concentration in mg/L which is zero at the bottom of the axis and increases with height. On the right vertical axis is the ammonia-nitrogen (i.e. ammonia measured as nitrogen) concentration also in mg/L which is zero at the bottom of the axis and increases with height. The bottom horizontal axis represents the ratio of chlorine (Cl_2) to ammonia (NH_3) by weight which is zero on the left and increases to the right. The bottom horizontal axis also represents time and increases from left to right. There are three inter-related lines on the graph:

- ΣN CONC.: (sigma ammonia-nitrogen concentration) represents the concentration of the sum of all forms of ammonia-nitrogen in the pool.
- Total Chlorine Applied: the constant dose of chlorine being introduced into the pool.
- Measured Chlorine Residual: the measured total chlorine residual in the pool.

The breakpoint curve is a graphical representation of chemical relationship that exists with constant addition of chlorine to swimming pool water containing a small amount of ammonia-nitrogen. This graph represents a swimming pool where bathing has ceased, and no further ammonia-nitrogen is introduced into the pool. During an overnight period, sodium hypochlorite is added at a constant rate. This curve has three zones.

Zone 1

Staring from the left side of the graph; there is already a concentration of ammonia-nitrogen (ΣN CONC) in the pool from bathers. Chlorine has been allowed to fall to zero and Total Applied Chlorine and Measured Chlorine Residual are both zero. Chlorine is then added at a constant rate. The principal reaction in Zone 1 is the reaction between chlorine and the ammonium ion. This reaction results in a Measured Total Chlorine of only monochloramine to the hump in the curve. The hump occurs, theoretically, at chlorine to ammonia-nitrogen weight ratio of 5:1. This ratio indicates the point where the reacting chlorine and ammonia-nitrogen molecules are present in solution in equal numbers. Monochloramine does not readily degrade.

Zone 2

The breakpoint phenomenon occurs in this zone which is also known as the chloramine destruction zone. As the weight ratio exceeds 5:1, some of the monochloramine starts reacting with further addition of chlorine to form dichloramine, which is about twice as germicidal as monochloramine. A pure dichloramine residual has a noticeable disagreeable taste and odor, while monochloramine does not. Total Chlorine Applied is still increasing and both the Concentration of ammonia-nitrogen and Measured Chlorine Residual decrease rapidly. This rapid decrease occurs because the dichloramine is reacting immediately with additional hypochlorous acid in a series of destruction reactions to form volatile compounds and other by-products such as nitrogen gas, nitrate and chloride. Therefore, ammonia and chlorine are consumed in the reactions and lost from the pool. Thus, additional chlorine is required to destroy ammonia and chloramines.

The breakpoint (Point A) is the point of the lowest concentration of Measured Chlorine Residual where nuisance chlorine residuals remain and where ammonia-nitrogen is not detected. The nuisance chlorine residuals are mainly organic chloramines which cannot be oxidized any further by reacting with hypochlorous acid.

Zone 3

Zone 3 is to the right of the breakpoint (Point A) and is where a free chlorine residual will appear. The total residual consists of the nuisance residuals plus free chlorine. If trichloramine is formed, it will appear in this zone. In practice it has been found the most pleasant water for bathing will occur if more than 85% of the total chlorine is free chlorine.

In reality, ammonia-nitrogen does not stay static but is continually added while the pool is open to the public. **To achieve breakpoint chlorination, chlorination must continue after the pool has been closed to the public to ensure oxidation of the additional chloramines.**

The shape of the breakpoint curve is affected by contact time, temperature, concentration of chlorine and ammonia, and pH. Higher concentrations of the chemicals increase the speed of the reactions.

*From https://www.health.nsw.gov.au/environment/factsheets/Pages/breakpoint-chlorination.aspx

Alternate Method for Calculating Chemical Additions to Achieve Breakpoint*

The formula for breakpoint chlorination using LIQUID chlorine (sodium hypochlorite):
Volume of the pool in gallons, times 8.3 (weight of one cubic ft. water), times the combined chlorine level (total chlorine minus the free available chlorine) times 1.0 (lbs. of chlorine in one gallon of liquid chlorine) times 10 (ten times combined chlorine level) divided by one million to calculate the amount of gallons of chlorine needed to reach breakpoint chlorination.

(POOL VOLUME (in gallons) × 8.3 × Combined Chlorine × 1.0 × 10) ÷ 1,000,000 = Gallons of sodium hypochlorite (12%) needed to reach breakpoint chlorination

Example: Calculate the chemical change to achieve Breakpoint Chlorination in 60,000 gallon pool with FC of 1.5 ppm and TC of 2.3 ppm. Using 12% Sodium Hypochlorite

STEP 1: Determine the amount of Combined Chlorine (CC)

Total Chlorine (TC) – Free Chlorine (FC) = Combined Chlorine (CC)

2.3 ppm – 1.5 ppm = **0.8 ppm**

STEP 2: Determine the amount of chemical to add:

Actual Pool Volume	Weight of one Gallon of Water	Combined Chlorine	Lbs. of chlorine in 1 gallon	10 Times CC Level	Divide by one million	Total
60,000	× 8.3	× .8	× 1	× 10	÷ 1,000,000	4 gallons

Step 1 must be done using a DPD test, using the test kit instructions.

In this example, 4 gallons of sodium hypochlorite is needed to properly reach breakpoint chlorination.

NOTE: When shocking a pool, the chlorine-based chemical used for shocking the water must be added all at once so that the concentration throughout the pool reaches breakpoint chlorination.

The formula for breakpoint chlorination using granular chlorine (calcium hypochlorite) is:

Volume of pool water in gallons times 8.3 (weight of one cu. ft. of water) times combined chlorine (CC) level (total chlorine minus the free available chlorine, determined from the D.P.D. test kit) times 1.5 lb. (weight of one pound of calcium hypochlorite) times 10 ppm representing 10 new, free available chlorine parts per million. Divide all the above by 1,000,000 to determine breakpoint in pounds of granular chlorine (calcium hypochlorite 67%) needed.

POOL VOLUME (in gallons) × 8.3 × COMBINED CHLORINE x 1.5 × 10 ÷ 1,000,000 = Free chlorine residual needed to reach breakpoint chlorination in pounds of granular chlorine

Example: Calculate the chemical change to achieve Breakpoint Chlorination in 60,000 gallon pool with FC of 1.5 ppm and TC of 2.3 ppm. Using 67% Calcium Hypochlorite

STEP 1: Determine the amount of Combined Chlorine (CC)

Total Chlorine (TC) – Free Chlorine (FC) = Combined Chlorine (CC)

2.3 ppm – 1.5 ppm = **0.8 ppm**

STEP 2: Determine the amount of chemical to add:

Actual Pool Volume	**Weight of one Gallon of Water**	**Combined Chlorine**	**Weight of Calcium Hypochlorite**	**10 Times CC Level**	**Divide by one million**	**Total**
60,000	× 8.3	× .8	× 1.5	× 10	÷ 1,000,000	6 Lbs.

Step 1 must be done using a DPD test, using the test kit instructions.

In this example, 6 pounds of calcium hypochlorite is needed to properly reach breakpoint chlorination.

*These calculations assume a free chlorine level of 0.0 ppm. They may leave a higher concentration of free chlorine after reaching breakpoint, but will ensure that breakpoint is reached.

For additional information on calculating chemical amounts to add to pools see: www.in.gov/isdh/files/Chemical_adjustment_pool.pdf

Idling Vehicles on School Property

It has been documented that idling vehicles contribute to a wide range of health and environmental problems including triggering asthma attacks, carbon monoxide poisoning, eye and respiratory irritation, contributing to ozone generation, and air pollution.

Researchers have also proven that not only is it not necessary for vehicles to idle, but periods of long idling cause more wear to the engine and waste fuel. Schools and corporations that have adopted idling programs have realized savings in fuel and vehicle maintenance costs.

The Indiana IAQ Rule 410 IAC 33-4-3 requires schools to adopt and enforce a policy limiting vehicle idling on school campuses. This applies to all vehicles on campus and not just school buses or school owned vehicles.

Consideration should be given to locations of building air intakes when evaluating "No Idling Zones" so as to minimize exhaust fumes being drawn into the building. Schools and school corporations may utilize the template sign available at the end of this section provided courtesy of the Indiana Department of Environmental Management, Protect Children at Child Care program (https://www.in.gov/idem/health/2342.htm).

Below is an example policy that schools may modify and adopt. In addition there are several policies available on the internet, such as one available at the IDEM's Protect Children at Child Care website (IDEM: Community Environmental Health: Protect Children at Child Care (in.gov))or at EPA's Idle-Free Schools Toolkit for a Healthy School Environment (Idle-Free Schools Toolkit for a Healthy School Environment | Healthy School Environments | US EPA).

Example Policy:
School Corporations are free to use and modify this policy to meet their needs.

***** **School Corporation Policy to Limit Vehicle Idling** **************************

A: Purpose – This policy is to limit vehicle emissions that might be brought into school buildings as mandated by 410 IAC 33-4-3. This will improve the health of students and staff through reduced exposure to these emissions.

B: Applicability – This policy applies to all public and private vehicles on the school campus.

C: Idling

1. **Posting**
    - **a)** The school shall post signs in areas where idling is prohibited

2. **Requirements**
    - **a)** Drivers of vehicles are to turn off the engine if the vehicle is to be stopped more than 5 minutes. (Engine cool down periods recommended by vehicle manufacturer may be followed)
    - **b)** The employer of the bus driver shall inform the bus driver of these requirements.
    - **c)** Teachers and school staff shall be informed of this policy at the start of each school year.
    - **d)** During student / parent orientations, parents, and all students shall be informed of this policy.
    - **e)** Any complaints of non-compliance are to be filed with the Superintendent's office.
    - **f)** Any complaints of non-compliance will be reviewed, and action taken as necessary.

D: Exemptions

1. **Safety of Children or Emergencies**
    - **a)** Use of lift equipment during loading or unloading of individuals with special needs.
    - **b)** Use of heater or air conditioning during loading or unloading of individuals with special needs.
    - **c)** Use of defrosters, heaters, air conditioners, or any other equipment for heath or safety concerns.
    - **d)** Use of bus headlights or flasher warning lights for safety or visibility purposes.
    - **e)** For other safety or emergency issues.
2. **Hot or Cold Weather**
    - **a)** If bus drivers are at a location more than 15 minutes, a waiting area should be provided for their use after turning off the bus engine.
    - **b)** From (beginning date) to (ending date) if necessary and the bus has air conditioning, the bus may idle for a minimal period to cool the bus prior to loading, or while students remain on the bus.

c) If necessary due to cold temperatures, a vehicle may idle for a minimal time to warm the vehicle.

3. **Maintenance Operations**
   a) (When possible, maintenance operations should not be conducted within 100 feet of a school building housing classrooms.) Buses may idle as necessary as part of a pre-trip safety inspection.
   b) If necessary to make emergency repairs to vehicles. (for example, jump starting another vehicle)