



THE HEALTHY AND SAFE FACILITY HANDBOOK

SCHOOL AND COLLEGE EDITION



healthy facilities institute®

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About This Handbook

The Healthy and Safe Facility Handbook **School and College Edition**

While discourse on green and sustainability topics abounds, there is a lack of concise, practical, systems information aimed at making educational environments healthier and safer.

The Healthy Facilities Institute (HFI) *Healthy and Safe Facility Handbook – School and College Edition* – provides actionable facts and steps to help you develop a system to:

- Improve and protect the indoor environment at your facility
- Provide better conditions for students, staff, faculty, and visitors
- Advance learning outcomes by enhancing safety and health

The audience for this handbook is not technical but general. It is designed to make the complicated simple while still being accurate, thus empowering laypersons to understand, affect, and improve health and safety issues in schools and colleges.

The subject of healthier indoor environments should be well-understood by all, not just experts. This guide will give you holistic information to move your educational facility toward a higher level of health and well-being to the benefit of the learning and teaching process.

Elements of Exposure

Breathing, Drinking, Eating, Touching, Ergonomics, General Safety and Security

Lowering indoor health risks enables students to learn better and teachers to teach more. Students and teachers cannot do their jobs properly if they are absent or impaired, and the facility environment is a factor.

Considering the Risk = Hazard x Exposure formula is a good beginning on the path to a healthier school or campus as the degree of Risk depends on the Hazardous Element multiplied by the amount of Exposure to it.

In this handbook, we explore Hazards related to breathing, drinking, eating, touching, ergonomics, general safety and security, and more; plus, ways to prevent exposure, and lower risk.

Exposure paths include:

- ▶ **Breathing:** Air is perhaps the number one route of exposure since humans take about 21,000 breaths of air daily; indoor air is often polluted and lungs, like sponges, absorb the exposure.
- ▶ **Drinking:** Since our bodies consist of mostly water, we need to replenish the supply regularly. What we drink along with that water counts and we will look at practical ways to lower risks in our water.
- ▶ **Eating:** Food is our friend only when nutritious and not contaminated with pathogens. This discussion will focus mainly on hygienic not nutritional concerns.
- ▶ **Touching:** Contaminants can enter our bodies through our skins by dermal exposure, hands can transfer germs into the body when we touch our eyes, nose, mouth; and irritants can damage our skin and cause discomfort. Preventing dermal exposure to toxics and pathogens is key.
- ▶ **Ergonomics:** 'Student bodies' and those of others are affected by how they use them when sitting, standing, and moving about. Musculoskeletal matters affect health and learning, and simple ergonomic measures make a big difference.
- ▶ **General Safety:** The focus here is on preventing slips and falls. The scope of this guide does not permit covering every environmental safety issue in education environments, but slip and falls are a preventable problem.
- ▶ **Security:** In recent decades, shootings and campus mayhem have created a need for preventive measures. We will summarize the best ideas as part of a system to help ensure a healthy and safe campus.

Healthy Architecture and Design

Ideally, healthy school buildings are designed to promote wellness and comfort from the start based on the factors below, among others. If your school or campus is older, you can still be your own architect and designer of health by following these principles.

Light

Access to wide-spectrum outdoor light from the Sun saves electrical energy indoors and evidence is we function best when living, teaching, or learning under full-spectrum light (excepting some types or levels of Ultraviolet that can damage eyes or skin). “Natural” non-glare light aids vision, color perception, energy, focus and performance.

Artificial wide-spectrum lights can help, and both types – natural and man-made – of non-glare light in the right wave-type and synchronization with daylight time, help reset circadian* rhythms, allowing for better sleep, rest, brain function, and health.

** Circadian rhythms are natural biological processes that happen on a 24-hour cycle. The scientific term for an amount of light that optimizes circadian rhythms is melanopic lux.*

Sound or acoustics

Unwanted sound is noise; it’s stressful and unhealthy. A quiet space is conducive to teaching, learning, and living. An inexpensive decibel meter (starting at <\$20) can help pinpoint loud (elevated decibel) sources.

Noise is defined by the ear of the listener; a teen listening to a rock station may not perceive that as noise, although his or her parents may.

Today’s designers are specifying acoustic materials for walls, ceilings, floors that muffle or absorb sounds for fewer distractions.

A set of foam earplugs can reduce decibels by 20-30db.

Temperature and Humidity

Cold, damp environments are unhealthy and so are hot, dry ones; as are all extremes.

The right temperature for comfort, teaching and learning depends on factors including air speed, human metabolism, clothing and other variables. Some say 68-74 F is a proper range, but the matter is far from settled.

Relative humidity (RH) or moisture in the air at a given temperature is also a health and comfort factor. RH between 30-50% is desirable.

In some cases, designers are incorporating localized controls in newer structures for customizing room temperature and RH by zones.

A standalone simple thermometer and humidistat can tell you a lot; although thermometers and humidistats linked to and controlling smart Heating Ventilating and Air Condition (HVAC) systems enable automatic adjustments.

In both newer and older buildings, “thermal controls” should include layering clothing so some persons can shed a layer and others can add a layer to stay comfy.

Installing wall or ceiling mounted fans aids local control. Personal, battery-powered fans may be an option.

Central Air Handling and Ventilation

Newer whole-building designs are smarter, enabling heating or cooling by zones and adequate ventilation without major energy loss using heat exchangers known as heat recovery ventilators (HRVs), or energy recovery ventilators (ERVs) which also aid in humidity control. Some systems monitor room-by-room VOCs and or Carbon Dioxide levels exhaled by breathing, and ventilate when levels exceed desired limits.

Short of that, try opening a window, but only if permitted by the HVAC department, and if there are no sources of pollution near the window.

LEED v4, the *WELL Building Standard*, and the *Living Building Challenge* offer guidelines for healthier air handling.

Outdoor access

Author Richard Louv in his book, *Last Child in the Woods* coined the term, *nature deficit disorder* to advise that people, especially children, should spend more time outdoors in nature or face a range of problems including attention deficit, stress, lower creativity, and impaired cognitive skills.

Educational spaces that enable greater access to the outdoors are healthier.

“67 percent of US building owners consider ... health impacts in their design and construction decision-making.” Dodge Data & Analytics

Health Factors

■ Indoor Air Quality

Helping ensure indoor air quality (IAQ) – with emphasis on the word “quality” – means striving for high-quality, healthy indoor air. Just as in quality-based manufacturing, sourcing is key.

Three Keys – EPA says there are three ways to improve IAQ:

1. Stop contaminants at the source
2. Ventilate
3. Clean or purify the air

Source Capture

Finding, reducing or eliminating pollution sources is step one. Make a list of sources that could be affecting IAQ and create a control or prevention strategy. This may involve an IAQ walkthrough to locate problem areas. The EPA provides an [IAQ Walkthrough Inspection Checklist](#) that is helpful.

Source Right

Since outdoor air is often cleaner than indoor air, bringing in fresher outdoor air as your main source makes sense, provided intakes are located away from emitters like idling diesel or gasoline-powered buses or cars.

Once outdoor supply or source air enters the “production line” of your Heating, Ventilating and Air Conditioning (HVAC) system, it is handled or processed by the system to provide the final product through distribution ducts and vents.

Ventilate

Integrate temperature and humidity control with systems that provide ventilation with a rate of air exchange and methods in harmony with ANSI/ASHRAE Standard 62.1 (Ventilation for Acceptable Indoor Air Quality).

The standard is updated every three years, and the current version is 62.1-2016. The ASHRAE standard is a starting not end-point to improve IAQ, as its provisions are designed as minimal measures. As a wise person said, “consider standards a floor, not a ceiling.”

Heat Recovery Ventilators (HRVs) or Energy Recovery Ventilators (ERVs) provide facility ventilation while recovering the energy from the outgoing airstream. In winter, an HRV or ERV exhausts stale indoor air while transferring heat energy from the outgoing air to the cooler incoming air using a heat exchanger. In summer, cooling energy is recovered from the exhaust stream. ERVs also enable humidity control.

Particulate Removal - Clean or Purify Air

Equip your air handling system with the most robust filtration medium possible (look for Minimum Efficiency Reporting Value or MERV 6-13; the higher the MERV rating, the better) while permitting enough airflow to meet ventilation needs.

Higher efficiency filters can reduce airflow, especially as they load, so must be balanced with HVAC air-moving capability. It is vital to regularly inspect, clean or replace these more efficient filters to avoid airflow problems or HVAC malfunction.

VOC, Gas Removal - Clean or Purify Air

HVAC systems generally remove particles not gases or VOCs.

Non-particle pollution requires different filter media such as activated carbon to adsorb (with a 'd') gases or VOCs. Since gas-type-filter media function differently than particle filters (e.g., MERV media), HVAC units equipped with this form of filtration will have different care and maintenance requirements.

Consider occupancy sensors in locations such as classrooms where carbon dioxide levels may provide a surrogate for overall VOC buildup, activating the ventilation system at preset CO2 limits.

Summary

The three IAQ keys in order of importance are:

- 1. Remove sources**
- 2. Ventilate well**
- 3. Filter well**

■ Chemical Exposure

When it comes to preventing chemical exposure, what is the best way to protect the 53 million children and 6 million adults in 120,000 public and private US school buildings?

The short answer is:

1. Find safer substitutes
2. Remove unnecessary chemicals
3. Store, use & dispose of hazardous substances with care
4. Drop “dose makes the poison” thinking (many chemicals even in miniscule amounts can be harmful over time).

Find Safer Substitutes, Remove Unnecessary Chemicals

Consult watchdog organizations such as:

- Environmental Working Group (EWG)
- Green Seal
- UL Environmental (ULE)
- GREENGUARD (a ULE Company)
- Safer Choice (EPA)

Compare their lists of what to avoid, with what is in your facility, then review recommendations for safer substitutes.

Area by area, take a written inventory of products in your building, assess for risks and benefits, then tag for removal or next steps.

Make a hitlist and sub-list of areas, then identify suspect chemicals:

- Classrooms
 - Chemistry or science labs
 - Items brought from home
- Cleaning and maintenance areas
 - Janitor closets
 - Utility sink areas
- Grounds Buildings
 - Pesticide and fertilizer cabinets
- Other Areas

In time, properly dispose of unlabeled, redundant, substances in damaged containers, unneeded or expired chemicals.

Remember to include furnishings and materials identified by groups such as GREENGUARD and ULE, and make a note of suspect items, for later disposition.

Prohibit unauthorized chemicals such as those in products brought from home, and move toxic substances away from food storage or preparation areas.

Use cleaning procedures that remove chemical residue.

Hazardous Substances

Understand the risk, hazard, and likely impact of chemical exposure by looking at product labels and Safety Data Sheets (SDS) based on the UN's Globally Harmonized System of Classification and Labelling of Chemicals (GHS) that the US adopted in 2012.

GHS Labels provide at-a-glance hazard info such as:

- Manufacturer Name, Address and Telephone Number
- Product Identifier
- Signal Word
- Hazard Statement(s)
- Precautionary Statement(s)
- Pictogram(s) (see examples below)



Watch for the signal words, "Danger" and "Warning." "Danger" is the strongest term, while "Warning" is less so.

The SDS provide more complete hazard, handling, disposal, protective equipment and spill information.

Train relevant staff on GHS labels and related SDS.

Keep these chemicals in a secure location for access only by qualified persons.

Drop “Dose Makes the Poison” Thinking

Endocrine Disruptors (EDs), chemicals that act like hormones, are active in parts per *billion* or *trillion*, and many products contain these ingredients.

EDs include:

- Glycol Ethers (sometimes in cleaning products)
- Phthalates (commonly in fragrances)
- Organophosphate compounds (in some pesticides)

Scientists once believed limiting exposure to harmful chemicals offered protection; a belief that led to dumping toxic chemicals into the oceans to dilute them, and permitting 80,000 or so untested chemicals (and mixtures of these) in a wide variety of products under a presumption of safety because there was no “smoking gun”, i.e., acute illness or fatality associated with exposure.

Now we know even tiny amounts of certain substances can have a long-term effect on people and wildlife by interfering with or mimicking hormones that promote cell growth, sexual development, and other key aspects of health.

Cancer, heart disease, obesity, organ damage, abnormal brain development, asthma, and other maladies are linked to these exposures. Fish in American waters are developing both male and female sex glands and other problems associated with EDs.

■ Water Quality

The Safe Drinking Water Act (SDWA), enacted in 1974, directs the US EPA to control the quality of water coming from public water systems. Ask for and review your system's annual Consumer Confidence Report, required of municipalities by EPA. This provides a helpful snapshot of the area's water quality.

Still, the problem for many schools and colleges is that while the public system is providing relatively safe water, the source of contamination (e.g., lead, copper, microbes) is the school's own plumbing systems and drinking fountains; i.e., contamination is happening at the point-of-use not "upstream". That is why, testing water coming out of drinking fountains, faucets and cafeteria taps is important.

Get the Lead Out – Testing, Testing, 1,2,3

Understand three points about the importance of testing for lead:

1. Even small amounts of ingested lead can affect behavior, impair learning and physical growth. High levels in the bloodstream can cause nerve problems, coma, convulsions and even death.
2. EPA provides helpful guidance for preventing lead exposure, and guidance on how to test for lead in [3T's for Reducing Lead in Drinking Water in Schools](#).
3. You can find a list of certified labs to test for lead and other contaminants on EPA's site <https://www.epa.gov/dwlabcert/contact-information-certification-programs-and-certified-laboratories-drinking-water>

Well - A Deep Subject

If your educational facility gets its water from a well, EPA treats your school or college like a public water system and requires regular testing and reporting to help ensure the water is safe. EPA also requires protecting the water source from contamination and maintaining the distribution pipes.

Filtration Can Help

Water treatment facilities often use chlorination to kill microbes, and chlorine can react with other substances to form hazardous byproducts in water such as trihalomethanes. Consider installing and maintaining water filters as they can provide an additional layer of protection from exposure to lead and other unwanted substances.

Final Steps

Clean and disinfect water fountains, faucet screens and aerators regularly.

■ Sound Levels

Since most learning happens through speaking, listening, and reading, the school ambient environment should be relatively quiet.

Quiet Defined

“Quiet” means the absence of major noise, echo, reverberation, or irritating pitch or tone, so teachers, students, and teaching-related audio, can be understood.

Tone, pitch, or frequency is important as shown by noise cancelling headphones that filter jet “noise” during travel, and the different perceptions of a) the screech of fingernails dragged across a chalkboard vs, b) the sound of a melodic voice, though the volume can be the same.

Source Control

As with the environmental elements of air and water, reducing sources of pollution is the first step.

Noise sources include extraneous voices, rattling or handling objects or paper, ringing bells, music, equipment sounds, road traffic, train and airport noise. Other noises are produced by or transmitted through:

- HVAC systems
- Ceilings
- Indoor walls
- Doors
- Windows
- Outdoor Walls

Check Classrooms for Noise

Two simple ways to check for noise levels in classrooms are:

1. Use a decibel meter, and
2. Do a speech intelligibility test.

Decibel Meter

The Acoustical Society of America (ASA) says a decibel meter can provide sound pressure or intensity over all frequencies expressed in decibels (dB). Simple decibel meters are available for less than \$25. The decibel scale is logarithmic, so each dB increase or decrease is substantial.

ASA suggests that background noise level in classrooms should not exceed 35 dB.

Note sample dB levels per ASA:

- Whisper – 20
- Quiet residence – 30
- Soft stereo in residence – 40
- Speech range – 50 to 70
- Cafeteria – 80
- Pneumatic jackhammer – 90
- Loud crowd noise – 100
- Accelerating motorcycle – 100
- Rock concert – 120
- Jet engine (75 feet away) – 140

Speech Intelligibility (SI)

Using a word list, recite each word from the back of the room, and have students write down what's heard. The percentage of correct words heard provides the classroom's speech intelligibility.

ASA notes that in many classrooms, SI is 75% or less. That's like reading a textbook with every fourth word missing!

Designing for Better Acoustics

Naturally, the best way to optimize room acoustics is through upfront, effective design and construction, and consulting a professional acoustical consultant in the process.

Wall, ceiling and flooring systems can be set up to absorb noise, enhance speech, and reduce unwanted echo and frequencies.

ASA offers a free download of ANSI Standard 12.60, Acoustical Performance Criteria, Design Requirements, and Guidelines for Schools, and free booklets on improving acoustics in classrooms <http://bit.ly/2jvzkIO>.

MAKING DO

In most cases, schools must make do with existing facilities to manage acoustics. The greatest solutions are often the simplest. Here are a few ideas:

1. *Add quiet sliders to chair or furniture legs*
2. *Create "Shh! Or Please Stop Talking" signs and have student monitors hold them up as needed.*

■ Lighting

Light is associated with knowledge, so there is no better place to consider proper lighting than a school or college environment, where it fosters learning by enabling better reading and access to visual information, plus health benefits.

Health Benefits of Light

Depending on who you ask, the right lighting can do anything from preventing cavities (due to the Vitamin D produced under natural light) and absenteeism to improving mood, energy, and academic performance.

Science shows humans function best and are healthiest under the right kind of light, as it affects circadian rhythms, mood, and well-being.

Thus, the best light is natural daylight, as it contains the full-spectrum of light that's a human birthright; and buildings that admit plenty of natural light, while avoiding direct sun and glare, are better for learning than those lit artificially with legacy incandescents or fluorescents.

Considering fiscal reality, though, what is the right light for classrooms? The short answer is: the most light a facility can afford that fills the human need for the proper spectrum of illumination.

Unless your facility is housed within one of the newer state-of-the-art green buildings with south-facing windows, control systems, and skylights for full access to daylighting, and broad-spectrum LEDs, you will need to replace older technology with artificial lights that have daylight characteristics.

Finding the Right Light – Take Inventory

Take inventory of all current lighting types and fixtures, window placement and orientation, buildings in which they function, and cost to operate.

Technology is your friend when it comes to better lighting as there are many options available.

Engage a reputable lighting consultant who can recommend realistic lighting plans and options for each facility. These may include replacing 34-watt T12 lamps with 32-watt T8 lamps in 4-foot fixtures, or replacing fluorescent tubes with CFLs or LEDs. In addition, a knowledgeable consultant can recommend occupancy and daylight-harvesting lighting sensors (that dim electrical lighting when sufficient outdoor light is available) and other options.

■ Cleaning and Disinfecting

Cleaning is the prevention or removal of unwanted matter, the first line of defense in protecting health, and a metaphor for most of what we are trying to accomplish with this handbook. For example, everyone wants clean air, clean water, clean indoor/outdoor environments, clean hands, and a clean “bill of health”.

This discussion will focus on cleaning and disinfecting indoor surfaces.

Cleaning precedes disinfection since you can't disinfect a dirty surface, and removing organic soil (soil that contains or supports microbial growth) is driving inspection and measurement of outcomes using ATP (adenosine triphosphate) meters that measure light emitted from organic soil remaining on surfaces. Rationale? If you can show removal of organics, you validate removal of germs or germ-food, leading to a more hygienic surface even before disinfecting.

Still, rather than focusing on inspection using ATP meters, which is like closing the barn door after the horse has escaped, it is first vital to focus on effective prevention or removal of organic soils.

In addition, cleaning should embrace prevention or removal of other soils such as dust, grit, heavy metals, and chemical pollutants.

Answering the following four questions will guide you on your cleaning journey:

1. Are our systems preventing soil?
1. Are we removing or just rearranging soil?
2. Is our disinfection effective (or needed)?
3. What is the Return on Investment (ROI) using a system?

Preventing Soil

First, have and maintain adequate 1) bi-level and 2) carpeted entry matting, which can trap gross soil and debris (bi-level) then dry/wipe shoe soles (carpet mat). The bi-level mat is first, followed by a nylon or synthetic fiber carpet mat with a nonslip waterproof backing. Select large enough mats to allow several steps across surfaces to enable removing mud, moisture, road dust, heavy metals, pesticide residues, and more. What is *not* tracked into buildings does not have to be removed later, and does not become airborne or ingested by young children.

Keep outside walkways clean to reduce dirt tracked in.

Use vacuum cleaners that remove and contain soils. Check the Carpet and Rug Institute (CRI) site for vacuum cleaners that meet standards for soil removal, indoor air quality, and carpet wear. The vacuum does not always need HEPA media, but the overall system should enable removal and retention of dust preventing it from being inhaled.

Also, consider banning facial tissue boxes as they emit tiny clouds of dust with each tissue dispensed.

Removing or Rearranging – Dust

Dusters are aptly-named when they rearrange or spread dust rather than remove it.

A damp microfiber cloth or tool is an effective dust-removal tool, while some dusters spread more particles than they remove.

Ideally, if your facility has an effective HVAC and air purifying system; your vacuum cleaners are well-filtered and -maintained; and you've eliminated or controlled indoor sources of dust such as desktop facial tissue, dusting is less of an issue.

Vacuuming does the best job where practical, microfiber is next in effectiveness, and black ostrich feather dusters a distant third.

Removing or Rearranging – Surface Soil

Above floors, use dampened microfiber cloths folded to enable eight fresh surfaces for wiping. These remove soils and even some bacteria.

On floors, since mops spread soil, replace most of them with equipment that applies fresh solution, then removes dissolved dirt using vacuum extraction, such as spray-and-vac or dispense-and-vac equipment.

Where mops are needed, consider using microfiber flat or string mops and rinse frequently to ensure you are removing more soil than you are spreading. Replace and launder mop heads and pads frequently.

Effective Disinfection

Disinfect touch points such as desk tops, door knobs, faucet handles, cafeteria tables, switch plates, and phones.

Disinfect only *clean* surfaces, or you are wasting time and money, and endangering health. Small amounts of organic soil (e.g., more than 5%) inactivate EPA-registered chemical disinfectants, so, in general, clean first.

Follow EPA-mandated label instructions carefully, such as keeping the surface wet with the disinfectant for 5-10 minutes of “dwell” to enable kill claims, while ensuring proper ventilation, and wearing personal protection (e.g., gloves and goggles).

Non-chemical interventions such as dry steam vapor can be highly effective at treatment times of just a few seconds, but directions are important to follow.

UV and other methods also enable disinfecting when used as directed on pre-cleaned surfaces.

Return on Investment (ROI)

Think long-term, not short-term. Invest in removal techniques and technologies and ROI is virtually assured.

ROI takes many forms including:

1. Asset preservation
1. Disease prevention
2. Health enhancements
3. Less absenteeism
4. Savings from waste-avoidance
5. Savings by eliminating unneeded chemicals
6. Labor savings from better processes.

■ Sanitizing and Foodservice

According to the School Nutrition Association (SNA), each day, some 90,000 schools serve breakfast and 100,000 serve lunch to 14 million and 30 million students respectively. The health and safety of foodservice is a paramount issue for healthy educational facilities.

Nutritionally speaking, menus should conform to the U.S. Department of Agriculture (USDA) *Nutrition Standards in the National School Lunch and School Breakfast Programs*:

<https://www.fns.usda.gov/school-meals/nutrition-standards-school-meals>

Per the *Food Allergy Research & Education (FARE)* group, 1 in every 13 US children – or about two in every classroom – have food allergies. FARE provides helpful resources on their website: <http://www.foodallergy.org/resources/schools>

The US Centers for Disease Control and Prevention (CDC) has published national guidelines for food allergy management in schools <http://www.foodallergy.org/cdc>. In cafeterias, these include:

- Encouraging children, school staff, and volunteers to wash hands before and after handling or consuming food.
- Washing tables and chairs with soap and water or all-purpose cleaning agents before each meal period. Consider squeegees for drying flat surfaces.
- Considering designated allergy-friendly seating during meals (open to any child eating foods free of identified allergens).
- Designate an allergen-safe food preparation area.

Handwashing 101

Wash your hands often.

- ▶ Wash with soap and water for at least 20 seconds (the time it takes to hum the “row, row, row your boat” song twice).
- ▶ Use hand sanitizer with at least 60% alcohol if you don’t have access to soap and water.

For cafeteria tabletop cleaning tips, see the section on *Cafeteria, Foodservice*.

The USDA Food and Nutrition Service, through an agreement with the National Food Service Management Institute have mandated Hazard Analysis Critical Control Point (HACCP) systems to help ensure hygienic environments and food safety.

HACCP is a holistic, systematic approach to the identification, evaluation, and control of food safety hazards based on the following seven principles:

Principle 1: Conduct a hazard analysis.

Principle 2: Determine the critical control points (CCPs).

Principle 3: Establish critical limits.

Principle 4: Establish monitoring procedures.

Principle 5: Establish corrective actions.

Principle 6: Establish verification procedures.

Principle 7: Establish record-keeping and documentation procedures.

Standard Operating Procedures (SOPs)

HACCP involves standard operating procedures (SOPs). USDA provides sample SOP checklists in several categories to help with applying HACCP:

Food Safety SOPs (e.g., Cleaning and Sanitizing Food Contact Surfaces)

Food Safety SOPs – Record Keeping

Developing Food Safety Program Worksheets

Please refer to the complete list and download the documents here

http://sop.nfsmi.org/sop_list.php

Monitoring the Environment

An interesting development in the monitoring of foodservice environments is the use of adenosine triphosphate (ATP) meters to detect organic soil that may harbor microbial growth. ATP devices enable establishing pass/caution/fail numbers or thresholds, with the higher the number, the greater the contamination. Properly-cleaned surfaces will show lower ATP numbers.

Software enables uploading meter data for numerical recordkeeping.

Advantages include:

- Instant results (available within seconds) to validate cleanliness or areas needing attention.
- Improve training techniques and processes through real-time performance feedback.
- Make better use of chemicals or cleaning supplies to achieve desired results without waste.
- Standardize cleanliness levels with numerical data showing due diligence in compliance with HACCP.

■ Integrated Pest Management

As the name indicates, Integrated Pest Management (IPM) means bringing parts together to create a larger whole. The combination of elements makes the individual parts work better in the spirit of the axiom: 'the whole is greater than the sum of the parts'.

The broader goal of IPM is to control or manage pests while protecting people, planet, and profit (or budgets), so interventions range from less to more toxic, starting with the most benign approaches first.

IPM involves understanding how at least five elements combine:

1. Pest life cycles and their environment
2. Pest control efficacy and costs
3. Pest control environmental, health, safety issues
4. Pesticides — conventional
5. Pesticides — naturally-derived.

Like a recipe where ingredients act together synergistically, five additional elements or steps include:

1. Prevention as the first line of defense. In buildings, this includes sealing cracks where insects or vermin can enter, eliminating food and water sources by limiting eating or drinking to locations such as the cafeteria, and effective cleaning.
2. Setting an action threshold by answering questions. How soon do we act to control a pest? How many sightings or what conditions are needed before we act? Is the economic or other threat significant enough to warrant an IPM effort?
3. Correctly identifying threatening versus non-threatening pests. Some insects are harmless or beneficial. Others are not, but if not properly identified could be treated wrongly and wastefully.
Just as a doctor diagnoses before prescribing, IPM seeks to understand the threat before acting.
4. Control. Biological control means using natural enemies to control pests and damage, or using pheromones to prevent mating. Cultural control means adopting preventive and other practices (see #1). Physical or mechanical control means zapping, trapping, physically removing, installing barriers or screens, and otherwise making the environment unfriendly to pests. Chemical control means selective, targeted use of pesticides, natural or synthetic.
5. Assessment. This is an ongoing periodic process to determine effectiveness.

■ Ergonomics

Ergonomics is an applied science that helps optimize activities such as learning and teaching while working with rather than against the human body through proper fit and other factors.

Key factors that enable ergonomics in educational facilities are:

1. Healthy learning & teaching positions and postures
2. Exercise that promotes healthy positions and postures
3. Tools, equipment, methods that enable #1 & #2
4. Healthy walking, carrying, transporting, and lifting

Healthy Positions and Postures

Since people vary in size and body form, and young persons are often still growing, consider furniture that both promotes proper posture and is adjustable.

Chairs need to support the lower back, and the lumbar area has a natural curve to it, so lumbar support is essential. Add a “pillow” to the area if replacing the chair is not an option.

Chair seat height should adjust so feet stay flat on the floor, or provide a footrest to avoid dangling feet. Arms should be at 90-degree angle.

Set up computer workstations for comfort and proper posture. Limit computer use to 30 minutes at a time unless using a standing desk. For additional resources on workstation set up: [Cornell University](#)

When using a laptop computer, raise it to eye level on an adjustable stand, and add an external keyboard.

When using a desktop computer, consider a trackball instead of a standard mouse, and ensure the line of sight is somewhat perpendicular to the monitor screen.

Tabletops and desktops that enable adjustable tilt may be helpful.

Extremes are bad whether it's too much reading at a monitor, sitting, standing, bending, squatting, stooping, reaching, etc. Vary positions and add activity breaks.

Exercise

Dr. John Ratey, author of the book, *Spark*, notes periodic exercise boosts brain performance and mental health.

US students ages eight to 18 sit at school 4.5 hours per day, 7 hours in front of a screen at home or elsewhere, at meals, to and from school; ultimately spending most of the day seated or sedentary (Ref: StandUpKids.org).

StandUpKids.org says: "Move more, sit less."

Tools, Equipment, Methods

As sitting is being called "the new smoking", consider providing standing desks that are adjustable for sitting or standing. Antifatigue mats can be placed as needed, and put away after use.

Encourage students with backpacks to make them no heavier than 10-15% of their body weight, and to use padded waist belts to distribute and balance the load on their hips.

Custodians should avoid lifting heavy mop buckets, and use equipment with a bottom drain spigot. Lay down trash barrels when removing full liners, and use barrels with air vents to allow easier bag removal.

[Ohio State University](#) provides additional ergonomic consulting, training and resources.

Healthy Walking, Carrying, Transporting, and Lifting

Keep walkways and stairs in good repair, mark uneven walkways with permanent yellow striping, provide extra handrails and or warning signage where needed.

Follow Americans with Disabilities Act (ADA) guidelines for safety and accessible design (this would also apply to restrooms, other areas).

Since most slips and falls occur walking on wet surfaces, consider:

1. Changing the surface (augmenting or replacing it with a high-traction material).
2. Changing the way you care for the existing surface (keep it clean, grease-free, and dry).
3. Adopting a documented Floor Monitoring Program as a subset of the overall written, trained, and documented Floor Safety Program, both of which should be mandatory.

Be aware of potential wet floors and outline countermeasures:

- a. Install and maintain entry matting to trap moisture and help dry shoe soles.
- b. Have caution signs available for temporary placement at entries during wet weather and other locations where spills occur (e.g., cafeteria or foodservice areas).
- c. Have equipment available to dry floors. While, in the past, this meant mops and buckets, newer, more nimble and affordable equipment exists to conveniently vacuum and squeegee liquids from floors, leaving them virtually dry. Ideally, use equipment and tools certified by the National Floor Safety Institute (NFSI).
- d. Monitor floors for potentially hazardous conditions, and set up inspection schedules with frequency and scope of inspection increasing to meet weather-related and other needs.
- e. Provide on-demand campus spill stations with Personal Protective Equipment (PPE) for the attending custodian, laminated visual "A, B, C" instructions, caution signs, absorbent material to soak up liquid, tools to safely remove broken glass and sweep up absorbed liquid, and a standardized drying method (mops and/or equipment).
- f. When a hazardous condition exists, have a school employee assigned to stand by, cordon off and "own" the spill or wet area until corrected.
- g. Specify routine floor cleaning methods and products, with safety signage; clean floors after school hours or at slow times, leaving floors rinsed and dry if possible. Observe surfaces, student and staff habits, floorcare and cleaning effectiveness; improve and document improvements.
- h. Encourage employees to wear shoes with non-slip soles.

More information: [National Floor Safety Institute \(NFSI\)](#)

Avoid carrying heavy objects while walking or those that obstruct your vision or could cause imbalance.

Use wheeled carts for moving heavy objects.

In general, lift using the legs not the back.

The US National Institute for Occupational Safety and Health (NIOSH) provides a *recommended lifting weight limit* of 51 pounds for one *adult* person depending on how often lifting occurs, the amount of twisting, the distance of the lift, the load position, and other factors.

Young or small students generally should lift less, of course.

Health by Areas

■ Classrooms

A healthy classroom enables students and teachers to be at their best, physically, mentally, and emotionally. Creating and maintaining a healthy classroom involves addressing issues in a holistic way as part of an ecosystem.

Healthy indoor air quality, water, ambient sound, lighting, cleaning, disinfecting, ergonomics, and more, are discussed in related chapters. We summarize other healthy-classroom system factors below.

Physically Healthy Classrooms

Childhood and adolescent obesity have increased dramatically in recent years, and more than one-third of adults are obese (Ref: CDC).

While sound diet and nutrition are vital, students and teachers should exercise and burn enough calories to be healthy and combat obesity.

Beyond supporting sports and physical education (PE), consider standing desks as they serve a dual purpose of heightening concentration and cognitive activity while burning calories. A 170-pound person burns 186 calories an hour standing vs 139 calories sitting, as the legs and back work harder when standing.

If your classroom is a “sitting” one, arrange for the class to stand up, stretch, and take breaks at regular intervals.

Carbon dioxide (CO₂) buildup from exhalation can create a lethargic and unhealthy classroom, so make ventilation a priority by working with your HVAC department. Indoor CO₂ buildup is a surrogate for elevated VOCs in general because if fresh air ventilation is poor, other gases will build up in the classroom as well. Request a simple CO₂, temperature, and relative humidity meter (<\$130) to periodically check your classroom CO₂. Partner with HVAC professionals to fine-tune these health factors.

Mentally and Emotionally Healthy Classrooms

Foster openness, support, and acceptance by applying these tips:

- According to the National Institute of Mental Health (NIMH), in 2015, 12.5% of the U.S. population aged 12 to 17 had a major depressive episode, so be sensitive to the prevalence of this illness.
- Normalize discussion about mental/emotional health by bringing it up regularly and in a matter-of-fact way.
- Get familiar with local mental health resources, post sources in the classroom, and call attention to them. Post the contact info of the school's mental health professional or guidance counselor.
- Try to make students feel safe about sharing their feelings. This will make it easier to identify, prevent and deal with problems.
- Ask students to do a healthy "self-checkup" by handing each one a worksheet saying: "Let's do a self-checkup to know what we're feeling, and look at problems or worries that bother us. Using an *A*, *B*, *C*, *D*, or *F* – grade how you feel right now. Jot your name on the paper, fold it so no one else can read it, and hand it in to me. You don't need to share your grade with others, but if you are a *D* or lower, check the 'want to talk' box, and we'll talk in private."
- Ask students to jot down the names of fellow students who seem unhappy, unhealthy, or unstable, and place the folded slips anonymously in a "Help Others" box to be checked regularly by a school counselor or other health professional.
- In short, show you care, and are there.

■ HVAC and Ceilings

Well-designed and maintained Heating, Ventilating and Air Conditioning (HVAC) systems are vital to a healthy indoor environment. They're called "air handlers" since they handle or process it by bringing fresh quantities indoors, filter, circulate, warm or cool it, then exhaust stale air outdoors.

Balanced systems hit the sweet spot of fresh air supply with stale air exhaust, while addressing filtration, temperature, relative humidity, and energy conservation.

Bringing Fresh Air Indoors to Counter TBS

During the US oil embargo of the 70s, many buildings reduced ventilation to save energy, too-often producing Tight Building Syndrome (TBS). Windows were nailed or bolted shut, buildings were insulated and sealed, and outdoor air exchange reduced.

In some cases, this led to Sick Building Syndrome (SBS), undefined health impacts, malaise, or discomfort associated with time spent inside specific buildings.

How Much Fresh Air and At What Cost?

A well-balanced HVAC system provides the right amount of fresh air, aka ventilation, to counteract TBS. ASHRAE recommends classroom fresh air exchange of 15 cubic feet per minute (cfm) of fresh air per person. Consider this a minimum requirement.

Technology has made this task easier through Demand Control Ventilation (DCV) systems activated by time of day, carbon dioxide levels, motion sensors, occupancy, or manually.

Manual activation helps when localized indoor pollution sources are elevated, for example, in a shop or art class where solvents or other VOCs are in use.

Remember, EPA says there are three ways to improve IAQ:

1. Stop contaminants at the source
2. Ventilate
3. Clean or purify the air

*Exceeding the ASHRAE standard threshold is not as important when you are controlling sources (see *Indoor Air Quality* section).*

Since source or supply air is from outdoors, consider electronically measuring air quality at the outside intake vent to in turn activate a damper to modulate air supply when outdoor air quality is poor.

Variable Frequency Drives (VFDs) in HVAC fan or blower systems help save energy by supplying just the power needed, not more.

Best of Both Worlds

Many facilities find using heat or energy recovery ventilators (HRV or ERVs respectively) helps provide enough fresh air without excess loss of energy. ERVs also help with humidity control.

Filter Facts

Air handlers can help to filter out two main kinds of contaminants:

- Particles (using high-MERV rated filters).
- Gases (using adsorption media filters that make the gas stick to the media, such as activated charcoal).

Particle filters that are efficient at trapping small particles need regular cleaning and replacement to avoid impeding airflow.

Adsorption media works differently and is rarely used in commercial HVAC units. This type of media is more commonly found in smaller room air purifiers. Source control is especially important with gases.

Carbon Monoxide Monitors

Exposure to Carbon Monoxide (CO) even in small amounts can be deadly. Sources include furnaces, water heaters, gas or Bunsen burners, automobiles, buses, and appliances fueled by oil, gas, or wood.

Carbon Monoxide detectors should be part of your HVAC system, and be in vulnerable areas (e.g., indoors near where cars or buses idle).

You can't be too careful with this dangerous and odorless gas.

Tips

- ▶ Tip: Make sure HVAC Inspection and Maintenance is planned, not left to chance. Change filters regularly. This also saves energy. As part of HVAC maintenance, clean coils and other elements to remove or reduce the chance of growing mold, and conserve energy. Check to ensure pans for condensate are draining.
- ▶ Tip: While some pollutants have no smell, the human nose can signal the presence of musty air, many odors, and pollutants. Find and eliminate sources (see *Indoor Air Quality* section).
- ▶ Tip: Be sure books and papers are not piled on top of HVAC units or vents, possibly blocking airflow.
- ▶ Tip: Regularly clean air supply diffusers, return grilles/registers and supply air intakes.

Roofs and Ceilings

When it comes to healthy indoor spaces, few places in the building envelope are as important as roofs and ceilings. Be sure these areas are inspected, do not leak, and have no cracks or holes.

Report problems promptly.

Ask to review the Preventive Maintenance (PM) plan for your building's roof and ceiling, and stay informed.

■ Furniture

Ergonomics may come first to mind when discussing healthy school furniture, but classroom furnishings impact health in at least three ways:

1. *Ergonomics*
2. *Enabling Movement*
3. *Indoor Air Quality*

Ergonomics

This refers to design and function for proper fit that works with rather than against the human body, promotes healthy positions and postures, and optimizes learning and teaching activities. See the chapter on Ergonomics.

Enabling Movement

Humans have more than 600 muscles, indicating the need to move, making the admonition to “sit [or stand] still” bad advice for the classroom, as total inactivity may lead to zoning out and physical problems.

Active or dynamic sitting is considered better by most experts, as moderate movement, ongoing body “adjustments” and even some minor wiggling may help circulate blood, oxygenate brain cells, prevent back problems, and improve concentration.

Chairs that adjust up, down, flex backwards, and swivel help with correct seat height, stretching, and facing the learning activity without twisting.

Foot and arm rests can aid comfort.

Casters on chairs and tables help enable rolling and repositioning furniture for different classroom learning and collaboration scenarios.

Adaptable and flexible furniture helps enable multiple learning and teaching styles.

Indoor Air Quality

Furniture that releases VOCs (Volatile Organic Compounds) can be harmful to health. Look for furnishings that have been certified as low-emitting by organizations such as GREENGUARD (a UL Environment company) and SCS Global Services.

Both organizations certify furnishings having low-emitting materials for use around sensitive or vulnerable people like children or sensitive adults, who spend considerable time in environments like classrooms.

Replace cloth upholstered furniture with sealed, low emitting surfaces.

■ Restrooms

The term “restroom” is meaningful as it implies a room of rest, safety, and privacy, where humans transfer biowaste. Restrooms are only restful and safe, though, when waste is promptly disposed of, removed or inactivated to prevent health concerns and odor.

Proper cleaning is the first line of defense, as correct process enables removal of germ-carrying or promoting organic soil, i.e., germ food, lessening the need to sanitize or disinfect as often. Less germ food = less disease risk = less need for harsh chemicals to disinfect (still, always wear gloves and goggles.)

Fresh Air Needed

Good ventilation is also vital to exhaust moisture, odor, airborne particles and microbes; and constitutes a form of cleaning the air. While some ventilation standards emphasize air changes per hour (ACH) based on the size of the restroom, this approach may be too general to optimize IAQ, as it does not factor in sources. A sound approach for determining restroom ventilation is airflow per plumbing fixture, for example 70cfm per toilet (ASHRAE 62.1 and model building codes). Local standards and codes apply, but the goal is healthier air, so be sure your ventilation fans are working.

Cleaning Process Questions

- Does the process clean effectively, or does it spread soils and cross contaminate?
- Is it removing pollutants, or is it adding unhealthy chemicals or substances to the environment?

Process 1

After emptying trash, removing visible debris, and replenishing supplies, prespraying surfaces to enable “dwell time” with a gentle water-based Green Seal certified or other semi-benign cleaning agent allows the liquid to do most of the heavy lifting by dissolving soils, reducing the need to agitate or scrub as much, while permitting gentler cleaners to be effective. Use a coarse spray to avoid aerosolizing and inhaling the cleaning chemicals (even *green* chemicals can be unhealthy).

Urinal and toilet bowl surfaces may require a mild acidic cleaner to dissolve mineral buildup, and or the use of a wet pumice stone for a reduced or chemical-free approach. Manual brushing is vital to remove biofilms that resist chemical agents. Avoid urinal blocks and fragrance dispensers that pollute the air.

Process 2

Wiping using microfiber removes more soil than other textiles, provided the microfiber cloth is first folded into quarters, then flipped to expose a total of 8 fresh cleaning surfaces.

Move from low-risk to high-risk surfaces, using a fresh cleaning surface per fixture.

Once all 8 surfaces have been used, replace the microfiber cloth with a fresh one. Soiled cloths should be laundered and replaced, especially when used on urinals and toilets.

Tooling Up

A powerful way of dissolving soil for rapid removal is using spray-and-vacuum equipment. The process works using an indoor pressure washer (e.g., 500 psi pressure) to spray tiled restroom surfaces from the top down, washing soils to the floor, where they can be squeegeed into a floor drain or vacuumed using a vacuum wand. The process is fast and effective and may be used for daily or weekly cleaning. It can lower labor costs.

For daily cleaning, there is a movement afoot to stop the mop, or reduce its usage, as it tends to redistribute soil and chemical residue, and leave it in grout lines. Spread-and-vacuum technology, aka dispense-and-vac is at the forefront of this shift.

Dispense-and-vac units for floors, have a mop-bucket footprint, but instead of using a mop and wringer, dispense fresh solution from a bottom spigot directly onto floors for agitation by an onboard scrub pad or by manual pole brushing, followed by vacuuming using the vacuum mounted over the rolling solution bucket. Another advantage of this technology is it leaves floors virtually dry, helping to prevent slips and falls.

Another trend is toward on-site generation of cleaners and disinfectants by ElectroChemical Activation (ECA) of solutions, using softened water (generated by the same system), salt, and a small amount of electricity to produce pure (low-sodium) separate streams of Green Seal certified cleaner and non-irritating hypochlorous-based disinfectant at costs ranging from \$0.05 to \$0.07 per gallon. These fragrance-free solutions can be produced and dispensed into holding tanks where they remain effective for 30 days or longer; and can be used in floor machines, buckets, and sprayers.

Lastly, dry (6% moisture) steam vapor technology enables cleaning restrooms with zero chemicals and simultaneously disinfecting surfaces in 3-5 seconds as opposed to many minutes using many EPA-registered chemicals.

Note: There is a time and place for EPA-registered disinfectants, such as when recommended by federal agencies during specific outbreaks. Always clean first, disinfect second, as you can't disinfect a dirty surface.

■ Floors

While the best floor type for educational facilities depends on the application, the health impacts of flooring are twofold:

- 1. Intrinsic impacts of the floor material itself, and*
- 2. Maintenance impacts.*

Intrinsic Health Impacts

While inert flooring materials such as terrazzo, ceramic tile, quarry tile or stone generally do not outgas volatile organic compounds (VOCs), health impacts may be linked to:

- Noise as harder surfaces reflect rather than absorb sounds, and
- Slips and falls as falling on a stone or terrazzo floor is more likely than falling on carpet, assuming both surfaces are in good repair.

The Carpet and Rug Institute's (CRI's) Green Label Plus (GLP) program recognizes "carpet, adhesives, and cushion with very low emissions of VOCs". Other material-related health considerations relate to:

- Emissions from newly installed GLP carpet that largely dissipate within 48 hours with good ventilation,
- Sound reduction as carpet absorbs sounds,
- Fewer slips/falls with related injury.

Sheet vinyl and vinyl composition tile (VCT) contain phthalates and or other plasticizers to provide flexibility, and phthalates have been linked to serious health issues. While phthalates are not VOCs, they can be abraded or rubbed off the surface and ingested by young children. They can also end up in airborne dust.

GREENGUARD Gold certification – featuring VOC emission standards to protect children in school, and complying with California 01350 – certifies floors, ceilings, furniture, counter-tops, doors, and other building-related materials for VOC emissions.

FloorScore (SCS Global Services) certifies low emissions for 35 Volatile Organic Compounds (VOCs) also in compliance with California 01350 for:

- Sheet Vinyl
- Vinyl Composition Tile (VCT)
- Rubber Flooring
- Vinyl Tile
- Luxury Vinyl Tile (LVT)
- Other Floors

Some facilities install interlocking carpet tiles to enable repair of damaged areas by replacing tiles, but moisture and spills could enter the backing from above and or moisture from below may create indoor air quality issues.

Vinyl Cushion Tufted Textile (VCTT) combines the benefits of smooth flooring with carpet. VCTT permanently bonds a textile or carpet-like surface with a closed-cell cushion layer impervious to moisture. VCTT is widely used in newer schools and in flooring upgrades as it looks like carpet, seals like vinyl, wears better than both, and solves the moisture incursion challenge often linked to flooring installation over concrete slab. CRI's GLP program applies.

Maintenance Health Impacts

Most health issues associated with installed flooring have more to do with maintenance than materials.

Clean and dry surfaces do not harm health, but dirty and damp ones do.

Carpet becomes allergenic or contributes to respiratory illness mainly when not well-maintained by frequent vacuuming. As it loads with dust, walking across the surface drives particles airborne.

Follow the 80/20 rule when vacuuming, focusing on the 20% of carpet that gets 80% of the foot traffic. Color-coding traffic areas to identify high, medium, and low traffic zones, plus places prone to spills or spots, will help target vacuuming and other maintenance.

CRI has rated vacuums for ability to clean, protect indoor air quality, and reduce carpet wear.

Carpet can contribute to other indoor air quality problems when "cleaned" using the wrong chemicals or methods, or when left too damp after extraction. CRI has also weighed in on approved cleaning chemicals, methods, and systems.

Ultimately, follow the carpet maker's recommendation for care, as they know their product best. For example, the maker of a leader VCTT floor-type advises the following to prevent excess moisture, and possible mold growth, after cleaning:

"Operate [the] heating, ventilation, and air-conditioning (HVAC) system during, and for at least 24 hours following, periodic cleaning with Hot Water Extraction. Utilize air movers, in conjunction with HVAC operation, to expedite drying." Good advice.

Prevention is Best

The best preventative advice is to install and maintain generous entry mats.

One carpet maker recommends not two but *three* levels of matting:

1. Entry-exterior scraper matting to remove gross soil and moisture
2. Entryway vestibule matting to remove additional dirt and wetness
3. Entry-interior matting to complete shoe sole cleaning and drying.

Of course, mats need daily vacuuming, weekly cleaning, and periodic replacement to keep working properly.

Mats are also vital in hard or smooth floor cleaning and care programs.

Soil Removal is Key

Hard or smooth floors also need proper care, and as with carpet cleaning, the key to healthy cleaning is soil removal.

Consider vacuuming floors rather than relying solely on dust mopping.

Vacuuming:

- Removes more soil from surfaces and grout lines than dust mopping,
- Lightens wet cleaning tasks, and
- Extends intervals for deep cleaning, stripping and refinishing.

A well-filtered vacuum also improves indoor air quality by capturing more dust than dust mops.

When using powered equipment, monitor sound levels for hearing protection, and use foam earplugs as appropriate.

Replace oil-based dust-mop treatments with green-certified water-based treatments.

Some newer systems, known as “autovacs”, remove dust and wet clean simultaneously.

Stop the Mops Where Possible

An emerging, cost-conservative trend in healthier floorcare is reducing or eliminating wet mopping by using spread-and-vac units that are similar in size to mop buckets, but eliminate redepositing dirty water by dispensing only clean solution to floors, agitating, then vacuuming away the sullied liquid to leave floors almost dry.

Reduce Reliance on Chemicals

Another trend enabled by newer technology is reducing the need for wholesale use of chemicals by focusing on improving the *process* of cleaning, notably through prevention, clean water application and near-total extraction.

Water remains the universal solvent, and using water more intelligently is reducing the need for reliance on petrochemistry, although effective chemical cleaners have their place, especially when they are green-certified for low emissions or toxicity.

Train, Don't Strain

Lastly, it is vital to train custodians in advanced processes.

On specialized floors, such as wood or synthetic gym floors, follow the manufacturers' recommendations for the maintenance process, training, and cleaning.

■ Stairs

Stairway use-habits, design, gravity and other factors may combine to create unsafe conditions.

There are two main causes of stairway accidents in schools and colleges:

1. Dangerous acts
2. Dangerous conditions

Dangerous acts

In sports, sometimes it is experienced players that have the most injuries. As an activity becomes routine, complacency may lead to carelessness, risk-taking, and dangerous actions.

Climbing and descending stairs is no different. Students, teachers and employees may daily and routinely go up and down stairs in education facilities, leading to dangerous acts including:

- Hurrying
- Talking, being distracted
- Reading
- Using a cell phone and texting
- Looking at a watch to check time
- Carrying objects, especially heavy ones that obstruct sight
- Not using the full width of the stair tread
- Taking two or more steps at once, aka “stair hopping” (students)
- Having untied shoe laces, or pants too long (students)
- Sliding down banisters or horseplay (students)

Many falls on stairs happen at entrances and exits. Entering a building involves a change in environment, with different lighting; and during bad weather, possible water, ice or snow on floors and stair treads. Going downstairs toward exits is a source of falls since haste to depart and funneling of traffic often leads to rushing, pushing, distractions and carelessness. (Reference: “An analysis of occupational stair accident patterns” – Cohen, Templer, et al)

Some research shows people only look at the first and the last several steps, and take the rest of the steps without looking; thus, if there are hazards in the intervening steps, a lack of attentiveness is dangerous.

Carelessness can also lead to misjudging the number of steps remaining.

Lastly, many persons do not use handrails, so any misstep could prove disastrous.

Dangerous conditions

Stairways, like walkways, are susceptible to dangerous conditions such as:

- Ice, snow, water, other substances
- Trip hazards
- Loose or broken surfaces
- Missing safety signage
- Poor lighting

Stairs may pose additional risks such as:

- Absent, broken handrails
- Missing nosing edge or strips
- Worn step tread

Tips for Stairway Safety and Maintenance

- Provide prominent visual or tactile cues to a stairway's presence: safety signs, change of floor color and or surface texture
- Ensure good lighting on steps and provide backup power to stair lights (repair or replace inoperative lighting promptly)
- Use safety-yellow color contrast on the leading edge of stair treads
- Use non-slip surfaces on stairs
- Keep the stairway clean, dry, and in good repair (remove spills, wetness or debris immediately)
- Regularly clean and disinfect handrails.
- Avoid storing objects on stairs or landings; keep stairways clear
- Schedule, document stairway cleaning, inspection, repairs, and safety modifications
- Schedule, document training employees and students in stair safety
- Encourage reporting problems with stairs immediately
- Encourage students and employees to use handrails and apply a "tennis-racket grip" for safety

Start a Take the Stairs Campaign

Follow the example of the Harvard School of Public Health's annual *Take the Stairs Campaign* "...aimed at increasing physical activity, improving human health (by getting people to take the stairs more often) and reducing environmental impact (by using the elevator less and thereby using less energy)."

Ensure Healthy Stairway Materials

As one example, FloorScore certification tests 35 Volatile Organic Compounds (VOCs) and certifies low-VOC emissions in compliance with California 01350 for stair treads and accessories.

Safe, Healthy Stair Governance

State and local building codes govern many aspects of stairway design and safety.

The Americans with Disabilities Act (ADA) Accessibility Guidelines (ADAAG) provides excellent guidance in Chapter 5: *Stairways* <http://bit.ly/2jNvJW9>.

■ Drinking Fountains

Water, learning, and wellness go together, as water hydration provides blood volume to supply oxygen to active brains, replaces empty-calorie beverages, reduces obesity, and promotes health.

Make sure your school wellness policy provides access to – and promotes drinking of – safe, tested, clean water through:

- Standard Drinking Fountains
- Fountains with Bottle-Fillers
- Standalone Bottle-Fillers
- Self-serve Refillable Containers with a Drinking Spout
- Other Delivery Points.

Safe, Tested Water

While safe drinking water may start in municipalities that test and treat water for quality at a public water system (PWS) facility, or in schools that draw water from a well that has been tested for water quality, it's what happens “downstream” through plumbing systems and access points that may determine how safe water is to drink.

It is vital to test water at the point-of-consumption, since contaminants like lead can leach into drinking water from the plumbing system, while coliform and other bacteria may enter downstream from the water source.

Testing Tips

Testing reveals water's characteristics and content, as a prelude to corrective measures. Develop a water testing protocol and response plan following federal, state, and local guidelines. In general:

- Take inventory of drinking fountains, bottle-fillers, and other drinking water access points.
- Identify where, when, frequency, and how you will sample.
- In plumbed sources, use “first-draw” samples after the access point has been unused for at least eight hours. If lead is dissolved in the water, it will be most apparent when water has been sitting in the pipes for an extended time.
- Use an accredited laboratory to analyze water samples, and possibly to gather them.
- Consult federal, state, and local guidelines for next steps.
- Consider filtration where practical.
- Document all efforts, including follow-up and cleaning.

Cleaning Best Practices

In high-traffic areas, several times per day, inspect fountains for cleanliness, trash or debris. Remove trash and foreign objects, then wipe with a disposable wipe or clean microfiber cloth or surface, going from clean to dirty (wipe the water outlet 1st, the handle or dispenser button 2nd, and the basin 3rd). Ideally, use a fresh wiping surface for each pass. Run the fountain for a few seconds to ensure the nozzle is clear.

Daily

- ▶ Wearing personal protection (e.g., gloves, goggles), disinfect using 1 tablespoon of bleach per gallon of water or more benign formulations such as ElectroChemically Activated (ECA) hypochlorous solutions generated on-site, hydrogen peroxide-based formulas, or other EPA-registered products with low-toxicity, following label directions and allowing enough dwell time for efficacy. Designate fountains as “out of service” during this process, and rinse well afterward with clean water.

Weekly, Monthly

- ▶ Vacuum ventilation grilles or cooling coils.
- ▶ Brush nozzles and outlets using water and a small, stiff, non-scratching brush (think toothbrush), as brushing is the only way to remove biofilm, that – like plaque on teeth – must be physically disrupted and rinsed away.
- ▶ Spray the entire surface with undiluted white vinegar, repeatedly as needed to keep the surface wet, to remove scale or mineral buildup. Use a small brush as above to help remove deposits. Designate fountains as “out of service” during this process, and rinse well with clean water.
- ▶ Check for leaks, condensation and for the presence of mold. Remove mold using water, detergent, and agitation. Report problems such as leaks or unusual noises to the maintenance team.

Drink Deep

Promote the drinking of water, and in high-traffic areas, use bottle-fillers to lessen wait time and optimize access.

Either provide water bottles for students (e.g., with the school’s logo on them), have them bring their own, or supply single-use paper cups.

If you provide the bottles, you will need to clean and disinfect them. Avoid those containing BPA. Of course, packaged, bottled water is an option, though a costly one.

■ Cafeteria and Foodservice

Cafeteria and foodservice areas present both health benefits and hazards. The goal is to drive the former and reduce the latter.

Driving Health Benefits

Healthy foodservice starts with sound nutrition – the focus of most guidelines at the federal, state, and local levels – but this section focuses on maintaining dining areas.

A healthy cafeteria (front of house, not kitchen) is a nutrition delivery system and environment in which students, staff, faculty, and visitors eat well, while having hygienic, safety, health and social needs met.

Since indoor air and water quality, ambient sound, floor care, cleaning and disinfection, and other topics are covered in previous sections, we will focus on two common, pressing health-related impacts and cafeteria needs:

1. Cleaning and sanitizing tables.
2. Preventing slips and falls.

Reducing Hazards

Cafeteria table top cleaning is challenging since the total surface area where food and drinks are placed and consumed is second only to floors. Thus, effective methods for removing soil and sanitizing these high-touch zones are vital to health, safety and affordable operations.

One advancement in large-surface-tabletop hygiene is a hybrid tool combining elements from the construction and window cleaning trades: The spreading trowel, squeegee, and extension pole.

Rather than spreading mortar, an operator (custodian) uses an 18-inch spreading trowel or Velcro® type-affixed pad holder holding a microfiber pad saturated with sanitizing solution to apply solution to and agitate table surfaces using a handgrip on the back of the trowel or an extension pole connected to the pad holder. This method enables applying sanitizer rapidly and generously to dissolve soils, following recommended wet “dwell time” required for germ kill, and large-area scrubbing without much “elbow grease”. The tabletop is then squeegeed dry, reducing labor by 50% compared to manual wiping, while providing thorough soil removal and hygienic outcomes as measured by ATP devices that detect remaining organic soil.

Floor safety in cafeterias is based on the principle that clean and dry surfaces are safe to walk on, making spill intervention and removal of liquids essential.

Cafeterias should have spill stations containing or having quick access to:

- Personal protective equipment such as gloves and goggles.
- Wet floor warning signage.
- A synthetic broom or handled brush and a plastic pan for removing gross debris, and small plastic liners to hold soils.
- Absorbent compound to soak up liquids.
- Liquid removal tools such as mops, or better, compact dispense-and-vacuum units that suction liquid from floors, rinse and dry them in one operation.

Cafeterias should have written floor safety monitoring programs, and employees should periodically inspect all floor areas during lunch and snack breaks, checking off inspected zones, making notes of incidents, logging date/time and follow up, and making sure a school employee “owns” the spill and stays with it until the floor is again clean and dry.

■ Locker Rooms

Clean, dry, well-ventilated locker rooms are healthy, while dirty, damp, and stuffy ones are not.

Clean

A clean locker room is one in which:

1. There are no body fluid residues (e.g., blood, sweat, or *tears* after disappointing performances) that can foster bacterial or fungal growth and odor.
2. There are no harmful airborne substances or VOCs to breathe, or chemical residues on flooring to irritate bare feet.
3. There are no visible or invisible soils to mar the appearance and health of the facility.

Check locker rooms several times a day for cleaning and security purposes.

Wear gloves and goggles.

During operating hours, remove trash and spot-clean/wipe using microfiber towels. Fold the microfiber towel into quarters for 8 new cleaning surfaces, and use all 8 surfaces before replacing the towel with a fresh one. A pump sprayer or powered hand-sprayer works best for high-demand spot-cleaning applications, as trigger sprayers cause fatigue when used repeatedly or heavily.

For occasional spills, a microfiber flat mop or string mop provides a quick fix.

Where needed, apply non-irritating solutions of EPA-registered sanitizers or disinfectants, following label directions. Wear gloves and goggles, and provide ventilation.

The best powered equipment for daily locker room cleaning is a spray-and-vacuum unit, as it gently “pressure washes” all watertight surfaces such as fixtures, sinks, counters, partitions, urinals, toilet exteriors, walls and floors, vacuums up the dirty liquid, and even blow dries the surface after washing.

Since this system relies mostly on a low-pressure (500 psi) water agitation and high-velocity vacuum removal process, fewer chemicals are needed, lowering operator exposure to cleaners, and decreasing drying time to prevent mold growth.

When using powered equipment, monitor noise levels to protect workers and occupants. Foam ear plugs are a low-cost intervention for operators.

Dry

Moisture is the enemy in locker rooms as high relative humidity (RH) promotes bacterial and mold growth, related odor, the survival of viruses and bacteria indoors, and surface corrosion.

Conversely, airborne transmission of flu viruses goes down in humid environments as the viruses absorb moisture and fall out of the air. That's one reason why flu spreads in winter's dry overheated indoor environments, as the virus stays airborne longer.

Still, in general, the problem is too much moisture in locker rooms, not too little, and one solution is to use a dehumidifier with a humidistat to control moisture levels, standalone or part of the HVAC system.

A desiccant system may also be effective. Types include:

1. Dry desiccant wheel: a slowly rotating absorbent wheel picks up moisture from the indoor air and exhausts it outdoors.
2. Liquid desiccant systems: these use a liquid (e.g., salt-type solutions) combined with heat to absorb moisture and transfer it outdoors, also functioning as air scrubbers.

Well-ventilated

Avoid the temptation to cover odors with fragrances, as these pollute the indoor air and their ingredients may promote illness.

When outside air is moderate in temperature and dryer than indoor air, ventilation is key to drying the locker room environment, including damp, sweat-laden uniforms and towels.

Since ventilation requirements are complex in these environments, consult an HVAC professional re: ASHRAE Standard 62, local standards, mechanical codes, and related building rating systems such as LEED.

■ Security

Schools should be safe and healthy places to learn and teach, but are increasingly not due to violence. While this largely reflects a societal not school problem, wise school administrators are being alert, watchful, and proactive.

- ▶▶ Knowing visitors, staff, students, and teachers, and requiring badges or photo IDs.
- ▶▶ Monitoring doors and gates.
- ▶▶ Locking certain doors and gates to control access.
- ▶▶ Using security cameras.
- ▶▶ Using metal detectors.
- ▶▶ Having strict dress codes.
- ▶▶ Using drug-sniffing dogs.
- ▶▶ Requiring uniforms for students.

Among the more interesting steps to consider are:

- ▶▶ Doorbells that activate cameras, both video and still, so before persons are admitted to the building, they press the doorbell, are viewed on a video monitor, have their picture taken, then, if permitted, enter a vestibule.
- ▶▶ Visitor Management Systems that require vestibule entrants provide ID activating a quick background check before further admittance.
- ▶▶ Brightly-colored lanyards and special IDs to wear on campus.
- ▶▶ Video monitoring of hallways and other areas, and access to video from mobile devices.
- ▶▶ Compact two-way radios for coordinating a quick response, and connecting with emergency personnel.
- ▶▶ Two-way radios that enable principals to interrupt other transmissions to report missing students or other problems.
- ▶▶ Principals and others can use their smartphones to communicate with radio users.

Two-Way Radios Versus Cell Phones

Some educational facilities needing quick responses use two-way radios not cell phones for communication. Why?

Two-way radios enable instant communication, as there is no voice mail, and on average calls last several seconds not several minutes. Their use enables quick audio communication to a group of users at the push of a button.

Two-way radios have a longer battery life (more than 15 hours in some cases) than cell phones, are designed to withstand drops from several feet and will keep working after being dropped.

Labs, Science and STEM

The economy of the future will focus on Science, Technology, Engineering, and Math (STEM), according the U.S. Bureau of Labor Statistics (BLS) that projects STEM-type jobs will grow to more than 9 million between 2012-2022.

Per BLS: "STEM workers use their knowledge of science, technology, engineering, or math to try to understand how the world works and to solve problems. Their work often involves the use of computers and other tools."

STEM Application to Indoor Environments

STEM seeks to foster interest in science, promoting understanding of science-based factors and metrics that affect indoor conditions and ecosystems. STEM applications could involve labs, life science classes, and related projects.

Related Projects

HFI can make available to schools a supply of [Foldscopes](#), paper microscopes invented by researchers at Stanford University and costing less than a \$1 to make, that fit in a shirt pocket and enable viewing microbial species easily in the classroom or elsewhere.

HFI also has interest in scientifically evaluating cleaning performance and outcomes by establishing a *Cleaning Performance Index (CPI) in schools*.

With a lack of existing research on surface-specific organic soil removal outcomes comparing discrete cleaning processes in pK-12 and higher education environments, there is a practical need for developing a pilot framework for a Cleaning Performance Index (CPI) that addresses the rate of soil removal, versus time and cost required for common interventions, beginning with student desktop cleaning (a common touchpoint surface with potential to spread pathogens) and grouted-tile cafeteria floors (which represent a high soil-load surface and cleaning challenge).

The project aims to establish a CPI indicator for four cleaning processes (two for each representative surface type above) integrating data on how much soil is removed, elapsed-process time, and related supply cost, using readily available or commonly practiced methods – in a cohort of five elementary schools or universities – with common surface types, including:

For Desktops

- ▶▶ Spray and Wipe using a Microfiber Cloth vs. (based on [ISSA](#) Data)
- ▶▶ Microfiber Trowel and Squeegee Method (based on [ISSA](#) Data)

For Grouted-tile Cafeteria Floors

- ▶▶ Mop Bucket and Wringer vs. (based on [ISSA](#) Data)
- ▶▶ Dispense-and-vac technology (based on [ISSA](#) Data)

CPI determination would be based on removing organic soil, defined as “soiling of biological origin” using Adenosine Triphosphate (ATP) measurement as the metric (although the soil and measurement metric would be different for vacuum cleaners, etc.)

Students could assist with ATP sampling and recordkeeping to arrive at outcomes that are statistically meaningful.

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