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Healthy and Safe Swimming: Pool Chemical–Associated Health Events

Editor's Note: NEHA strives to provide up-to-date and relevant information on environmental health and to build partnerships in the profession. In pursuit of these goals, we feature a column from the Environmental Health Services Branch (EHSB) of the Centers for Disease Control and Prevention (CDC) in every issue of the *Journal*.

In this column, EHSB and guest authors from across CDC will highlight a variety of concerns, opportunities, challenges, and successes that we all share in environmental public health. EHSB's objective is to strengthen the role of state, local, and national environmental health programs and professionals to anticipate, identify, and respond to adverse environmental exposures and the consequences of these exposures for human health. The services being developed through EHSB include access to topical, relevant, and scientific information; consultation; and assistance to environmental health specialists, sanitarians, and environmental health professionals and practitioners.

The conclusions in this article are those of the author(s) and do not necessarily represent the views of CDC.

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Chemicals are added to the water in treated recreational water venues (e.g., pools, hot tubs/spas, and interactive fountains) to inactivate pathogens, maximize the efficacy of the disinfection process (e.g., pH control), improve water quality, stop corrosion and scaling of equipment, and protect against algal growth. Each year, however, pool chemical–associated health events lead to 3,000–5,000 visits to emergency departments across the U.S. (National Electronic Injury Surveillance System, 2013). The most common diagnoses are poisoning (i.e.,

ingestion of pool chemicals or inhalation of dust or fumes) and dermatitis or conjunctivitis, which result from chemical splashes onto skin or into the eyes. The injured include pool operators, other aquatics staff, and the general public; however, those under 18 years of age are disproportionately affected. Pool chemical–associated health events occur in both residential and public settings, and they most frequently occur during the summer and on the weekends.

State and local investigations into the factors leading to pool chemical–associ-

ated health events reveal common themes (Centers for Disease Control and Prevention [CDC], 2009; CDC, 2011; Hlavsa et al., 2011). The health events demonstrate the lack of use of personal protective equipment (PPE) (e.g., safety goggles or masks); they frequently occur when containers or packaging are opened, water is added to a chemical (i.e., instead of a chemical being added to water), equipment fails, or chemicals violently react. Violent chemical reactions can result from predissolving pool chemicals that should not be predissolved or mixing incompatible pool chemicals, particularly chlorine and acid. Pool chemical–associated health events that affect the most individuals and thus make national headlines frequently result from the following scenario: the recirculation pump shuts down while the chlorine and acid feed pumps continue to run; chlorine and acid mix within the static water return lines without dilution, generating toxic chlorine gas; and then when the recirculation pump is restarted, patrons and the aquatics staff are exposed to the toxic chlorine gas. Additionally, children frequently access chemical storage areas or are present while pool chemicals are being handled.

Prevention Through Education

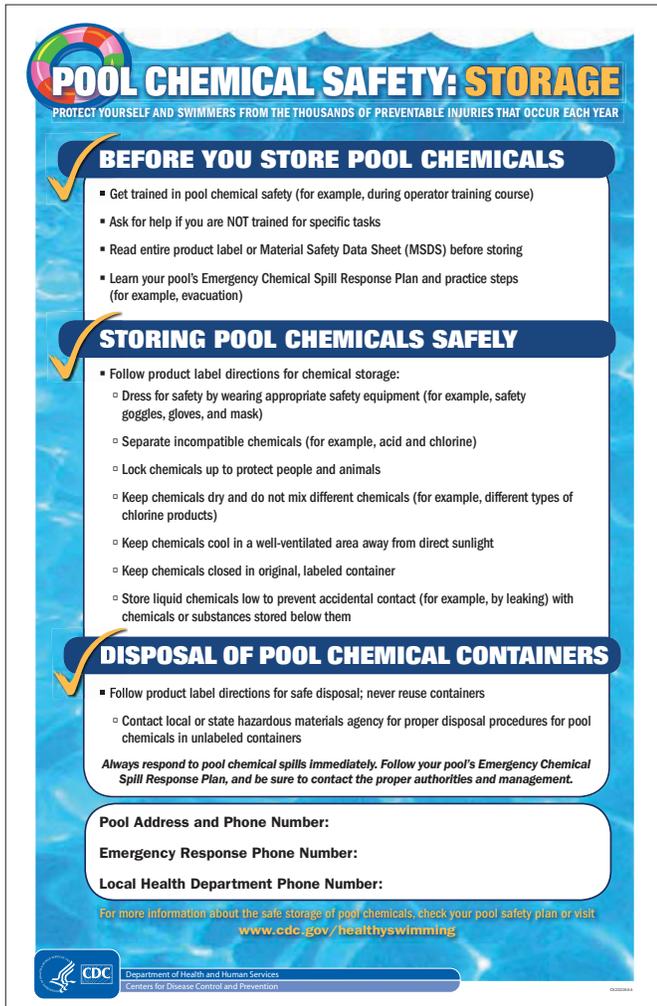
Pool chemical–associated health events can be prevented through a combination of education, engineering, and environmental health policy. The Centers for Disease Control and Prevention's (CDC's) recommendations for preventing these health events, based on analysis of data collected during state and local investigations, can be found

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FIGURE 1

Free Pool Chemical Safety Posters Available in English and Spanish

a



POOL CHEMICAL SAFETY: STORAGE
PROTECT YOURSELF AND SWIMMERS FROM THE THOUSANDS OF PREVENTABLE INJURIES THAT OCCUR EACH YEAR

BEFORE YOU STORE POOL CHEMICALS

- Get trained in pool chemical safety (for example, during operator training course)
- Ask for help if you are NOT trained for specific tasks
- Read entire product label or Material Safety Data Sheet (MSDS) before storing
- Learn your pool's Emergency Chemical Spill Response Plan and practice steps (for example, evacuation)

STORING POOL CHEMICALS SAFELY

- Follow product label directions for chemical storage:
 - Dress for safety by wearing appropriate safety equipment (for example, safety goggles, gloves, and mask)
 - Separate incompatible chemicals (for example, acid and chlorine)
 - Lock chemicals up to protect people and animals
 - Keep chemicals dry and do not mix different chemicals (for example, different types of chlorine products)
 - Keep chemicals cool in a well-ventilated area away from direct sunlight
 - Keep chemicals closed in original, labeled container
 - Store liquid chemicals low to prevent accidental contact (for example, by leaking) with chemicals or substances stored below them

DISPOSAL OF POOL CHEMICAL CONTAINERS

- Follow product label directions for safe disposal; never reuse containers
 - Contact local or state hazardous materials agency for proper disposal procedures for pool chemicals in unlabeled containers

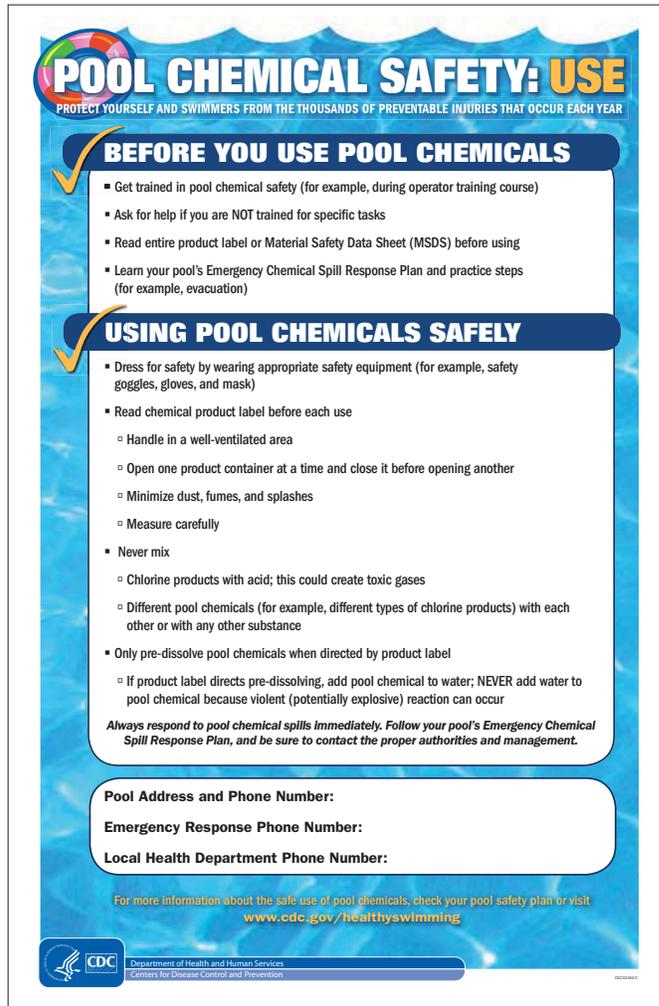
Always respond to pool chemical spills immediately. Follow your pool's Emergency Chemical Spill Response Plan, and be sure to contact the proper authorities and management.

Pool Address and Phone Number:
Emergency Response Phone Number:
Local Health Department Phone Number:

For more information about the safe storage of pool chemicals, check your pool safety plan or visit www.cdc.gov/healthyswimming

 Department of Health and Human Services
Centers for Disease Control and Prevention

b



POOL CHEMICAL SAFETY: USE
PROTECT YOURSELF AND SWIMMERS FROM THE THOUSANDS OF PREVENTABLE INJURIES THAT OCCUR EACH YEAR

BEFORE YOU USE POOL CHEMICALS

- Get trained in pool chemical safety (for example, during operator training course)
- Ask for help if you are NOT trained for specific tasks
- Read entire product label or Material Safety Data Sheet (MSDS) before using
- Learn your pool's Emergency Chemical Spill Response Plan and practice steps (for example, evacuation)

USING POOL CHEMICALS SAFELY

- Dress for safety by wearing appropriate safety equipment (for example, safety goggles, gloves, and mask)
- Read chemical product label before each use
 - Handle in a well-ventilated area
 - Open one product container at a time and close it before opening another
 - Minimize dust, fumes, and splashes
 - Measure carefully
- Never mix
 - Chlorine products with acid; this could create toxic gases
 - Different pool chemicals (for example, different types of chlorine products) with each other or with any other substance
- Only pre-dissolve pool chemicals when directed by product label
 - If product label directs pre-dissolving, add pool chemical to water; NEVER add water to pool chemical because violent (potentially explosive) reaction can occur

Always respond to pool chemical spills immediately. Follow your pool's Emergency Chemical Spill Response Plan, and be sure to contact the proper authorities and management.

Pool Address and Phone Number:
Emergency Response Phone Number:
Local Health Department Phone Number:

For more information about the safe use of pool chemicals, check your pool safety plan or visit www.cdc.gov/healthyswimming

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Print your own or order laminated copies at www.cdc.gov/healthywater/swimming/resources/posters.html#chemical.

at www.cdc.gov/healthywater/swimming/pools/preventing-pool-chemical-injuries.html. A public-private partnership has resulted in the development of health education resources that focus on prevention and target pool operators and residential pool owners. CDC's Healthy Swimming Program, the Agency for Toxic Substances and Disease Registry's National Toxic Substances Incidents Program (NTSIP), and the American Chemistry Council (ACC) collaborated on the evaluation of a CDC pool chemical safety poster. Based on the evaluation, two

new posters were developed, one on safe storage and the other on safe use; both are written in English and Spanish. Thanks to the generous financial support of ACC, CDC printed and laminated approximately 54,000 copies of the two posters (Figure 1). They can be ordered for free at www.cdc.gov/healthywater/swimming/resources/posters.html#chemical. At the state level, our colleagues in New York, an NTSIP site, have also created pool chemical safety fact sheets, which are available at www.health.ny.gov/environmental/chemicals/pool_chems/.

Prevention Through Engineering and Environmental Health Policy: The Model Aquatic Health Code (MAHC) in Action

Pool chemical-associated health events can also be prevented by combining engineering features with environmental health policy. Since 2007, CDC and New York State have spearheaded a national multistakeholder (e.g., the aquatics sector) effort to create the MAHC (www.cdc.gov/MAHC). The MAHC is intended to help local and state agencies incorporate science-based practices into pool

programs that regulate the design, construction, operation, and maintenance of public, treated recreational water venues, negating the need to “reinvent the wheel” in individual jurisdictions across the U.S. The MAHC will be a resource for local and state agencies looking to voluntarily adopt or revise public health laws related to preventing illness and injury associated with these venues, addressing the full scope of public health issues, including pool chemical-associated health events. For example, MAHC’s proposed design standards are intended to prevent the common chemical mixing incidents caused when recirculation pumps shut down and chemical feed pumps continue to run by requiring installation of electrical interlocks or flow sensors.

The proposed MAHC standards might also help prevent pool chemical-associated health events by requiring operator training on pool chemical safety and use of appropriate PPE when handling pool chemicals, and, for new construction, designing chemical rooms to

1) ventilate to the outside of the building and 2) minimize mixing and close storage of incompatible pool chemicals. The first edition of the MAHC should be completed following two rounds of public comment before the 2014 swim season so it is not too late for everyone to have input via the public comment process. Read the draft MAHC standards and learn more about the public comment process at www.cdc.gov/mahc. 🐼

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