Preventing Chlorine & Acid Mixing at the Pool: Unintended Releases of Chlorine Gas at Aquatic Facilities

International Pool and Spa Expo Conference

Las Vegas, NV
November 1, 2018
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OUTLINE

- Problem-what happens?
- How does it happen?
- How to prevent
Unintended Releases of Chlorine Gas

- **WHAT HAPPENS?**
  - Chlorine gas released when chlorine and acid are mixed

- **HOW DOES IT HAPPEN?**
  - Mechanical Failure
  - Human Factors
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- Impact
  - Approximately 5,000 pool-chemical related injuries treated in emergency rooms each year
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- Mechanical Failure
  - Chlorine and acid pumps continue to feed when no flow in recirculation system
    - No effective electrical interlock
      - Show video
        » American Chemistry Council-“Preventing Unintended Chemical Injection”
          (https://www.youtube.com/watch?v=4TjgvL8Ln18&t=1s)
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- **PREVENTION**
  - How does the Model Aquatic Health Code (MAHC) help?

- **Mechanical (Design criteria)**
  - Interlock controls and no or low flow deactivation (MAHC Section 4.7.3.2.1.3)
    - Electrical interlock with at least 2 of the following:
      - Recirc. pump power monitor
      - Flow meter/flow switch in return line
      - Flow meter/flow switch at chemical controller
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- Mechanical (design criteria) continued
  - Electrical interlock system installed per manufacturer’s instructions with no subsequent alterations allowed
  - Visual Alarm (or other indication)
    - Initiated to alert staff if chemical feeder is disabled through electrical interlock
      » Bathers to be evacuated from pool
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- Mechanical (operational criteria)
  - Chemical feed system components to be interlocked
    - Chemical feeders cannot operate when recirc. system has no or low flow (MAHC Section 5.7.3.5.1.2)
  - Bathers to be evacuated from aquatic venue when:
    - Interlock is activated, or
    - Recirculation pump stops
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- Mechanical (operational criteria)
  - Bather Re-entry not permitted until:
    - Cause of interlock activation and/or recirc. pump interruption determined and the recirc. pump and chemical feeders run a minimum of 5 minutes (MAHC Section 5.7.3.5.1.2.2)
    - Upon backwashing, the recirc. pump and chemical feeders must run a minimum of 5 minutes before allowing bathers to reenter pool (MAHC Section 5.7.2.2.4.1.1)
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- Mechanical (operational criteria)
  - Challenge Testing
    - Monthly challenge testing of chemical feeder interlock system
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- Human Factors
  - Erroneous mixing of chlorine and acid
    - Contributing factors
      - Lack/or inadequate training of staff
      - Lack/improper labeling of chemical containers/crocks
      - Improper storage/handling
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- **PREVENTION**
  - How does the Model Aquatic Health Code (MAHC) help?

- **Training**
  - Qualified Operators required (MAHC Section 6.3.1)
    - Qualified operator qualifications, training and certification requirements in MAHC Section 6.1.1
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- Training
  - Staff training required prior to access of chemicals and annual review of procedures thereafter
    - Qualified operators
    - Responsible supervisors
    - Maintenance staff
    - Others involved in storage, use, or handling of chemicals
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- **Labeling**
  - All chemical feed system components to be dedicated to a single chemical and clearly labeled.
  - All chemical containers to be labeled per OSHA and/or EPA requirements

- **Handling**
  - Measuring devices
    - Dedicated and compatible with chemical
    - kept clean and dry
  - Never mix 2 or more chemicals together
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- **Storage**
  - Protection from getting wet
  - Stored so if packages leak, no mixing of incompatible materials
2018 MAHC 3rd Edition Released
The findings and conclusions in this report are those of the authors and do not necessarily represent the official position of the Centers for Disease Control and Prevention.