

The Centers for Disease Control and Prevention's Vessel Sanitation Program is proud to bring to you the following session:

Swimming Pools and Whirlpool Spas

While this presentation is primarily intended for cruise vessels under the jurisdiction of the Vessel Sanitation Program it may also be used by anyone who is interested in this topic.

This session should not be used as a replacement for existing interactive training but should be used as an adjunct to a comprehensive training program.



SAFER • HEALTHIER • PEOPLE™



Swimming Pools and Whirlpool Spas

Vessel Sanitation Program

2007



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Learning Objectives

- List the types of recreational water illnesses and the pathogens that cause them.
- List the ways in which a pool can be operated to control pathogens.
- List the parameters that should be monitored and controlled to ensure water quality in pools and whirlpool spas.
- List the safety features required for life saving at swimming pools.



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Hazards and Recreational Water Illnesses (RWI) Associated with Recreational Water

- Injuries
- Contact skin illnesses
- Ear infections
- Eye infections
- Wound infections
- Gastrointestinal illnesses
- Respiratory illnesses



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Recreational Water Use is Associated with a Spectrum of Illness in Treated Aquatic Venues

- Diarrheal illness
 - *Cryptosporidium*, toxigenic *E. coli*, *Giardia*, *Shigella*, noroviruses
- Skin infections
 - *Pseudomonas* dermatitis/folliculitis
- Outer ear and eye infections
 - *Pseudomonas*, adenoviruses
- Respiratory
 - *Legionella*



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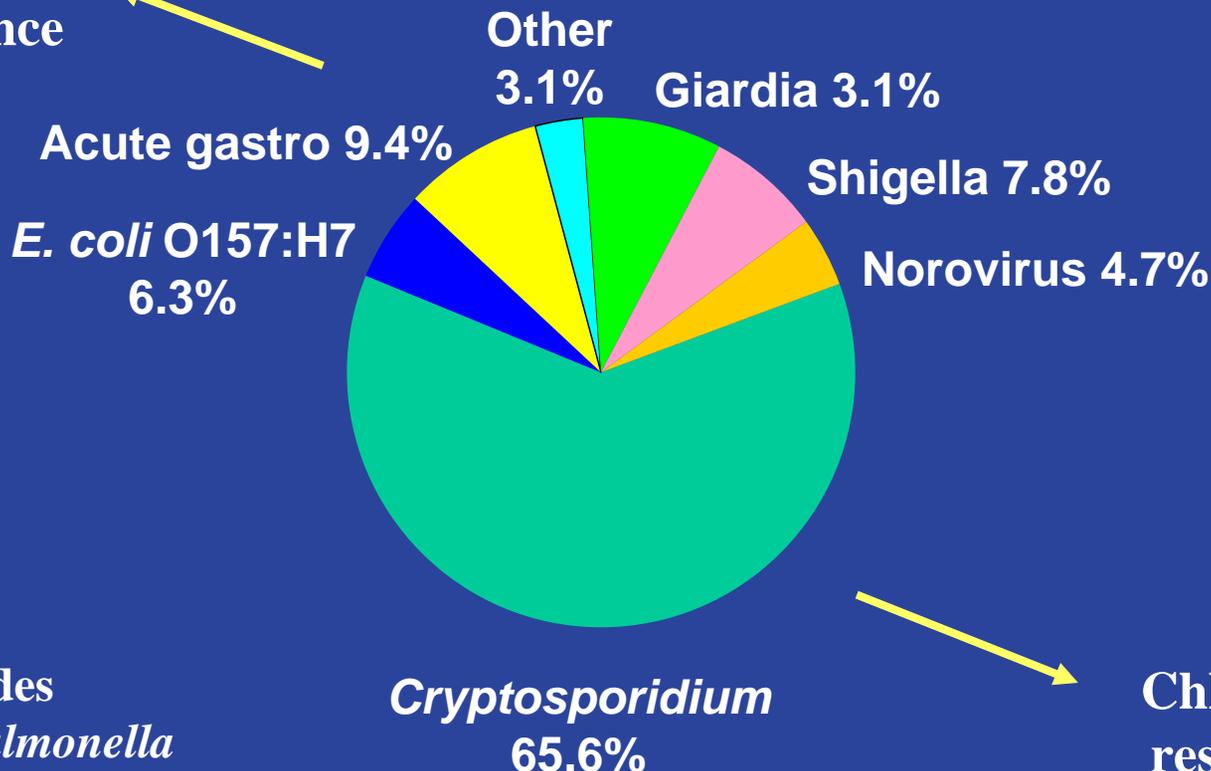
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RWI Outbreaks, United States, 1993-2002; Diarrhea in Treated Venues (N=64)

Chlorine-sensitive:

Poor pool
maintenance



Other includes
Campylobacter, *Salmonella*
MMWR (2004) 53(SS08):1-22

Chlorine
resistant



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Types of Pools

- Swimming
- Wading/Splash
 - Kid's pool



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Swimming Pool Operation

- Flow-through seawater pools
- Recirculated water pools



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Flow-through Seawater Pools



- Vessel underway
- 20 kilometers (12 miles)
- Can be switched to recirculating pool

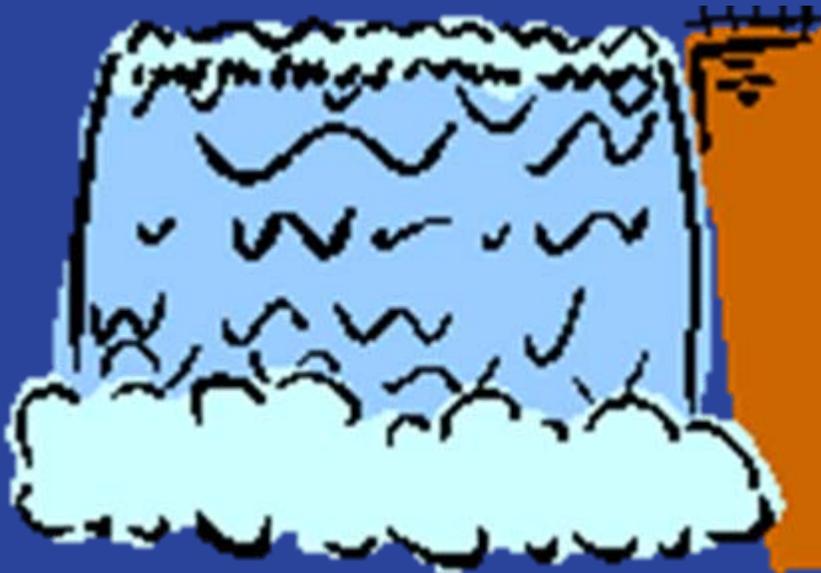


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Flow Through Mode



- No treatment required



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Recirculated Pools



- Anytime
- Anywhere
- Filtered
- Halogenated



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Recirculated Swimming Pool Filtration



- Pressure Differentials
- Backwash or clean
- Inspection
- Change



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Recirculated Pool Water Quality



- Filtration and flow rates
- pH
- Alkalinity
- Clarity
- Water Source
 - Potable
 - Seawater



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Recirculated Pools Halogenation



- Monitored every 4 hours
- 1.0-5.0 ppm
 - Bromine
 - Chlorine



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Swimming Pool Safety Equipment

- Appropriate flotation device
 - Rope attached
- Shepherd's hook
- Depth markers



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Typical Pool Safety Signs



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Public Whirlpool Spas



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What's In the Air?



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What is *Legionella*?

- Mycobacterium legionella
- Widely distributed in natural and manmade water systems
 - Freshwater systems
 - Intracellular parasite of free-living ameba



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Legionellosis

- Two forms of illness
 - Pontiac fever
 - Milder, flu-like symptoms
 - Incubation 2-48 hours
 - Legionellosis
 - Severe pneumonia
 - Incubation 2-14 days



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Historical Perspective on *Legionella*

- 1976 American Legion convention in Philadelphia
- 182 cases of pneumonia, 29 deaths
- Outbreak associated with a new bacteria not previously linked to human illness
 - New bacterium named *Legionella pneumophila*
- Bacteria growing in cooling tower were introduced in the hotel HVAC system

NEJM, 297:1189-1197



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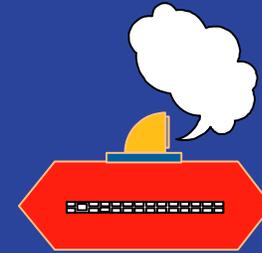
Mechanisms of *Legionella* Transmission



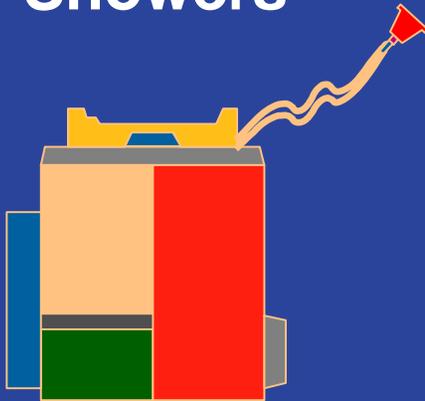
Showers



Whirlpools



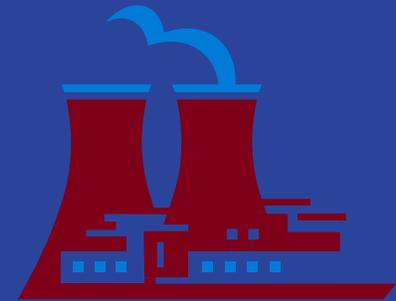
Humidifiers



Respiratory
therapy
equipment



Faucets



Cooling towers



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Key Points Regarding Transmission

- No person-to-person transmission
- Natural environments (e.g., lakes, rivers) do NOT have sufficient quantities of *Legionella* to cause transmission
 - Many spas may have *Legionella* but levels are not high enough to cause disease
- Don't need to get in the water—just breathe air in vicinity



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Whirlpool Water Quality

- Clarity
- Alkalinity
- pH
- Filtration and flow rates
- Halogen residual
- Water changed daily
 - Spa Pools exempt from this requirement



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Halogen Residuals and pH

- Chlorine
 - ≥ 3.0 - ≤ 10.0 ppm
- Bromine
 - ≥ 4.0 - ≤ 10.0 ppm
- pH
 - 7.2 – 7.8



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Halogen Monitoring

- Measured and recorded
 - Hourly
 - or
 - Automated Analyzer
 - Calibration checked and recorded daily



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$$TC = FC + CC$$

- Free chlorine
 - active disinfectant available
- Combined chlorine
 - chlorine bound with ammonia or organic compounds
- Combined chlorine
 - 0.2-0.5 PPM



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Break Point Chlorination

- Adding enough chlorine to eliminate problems associated with combined chlorine
- Does not affect organic combined chlorines
- 10 times amount of combined chlorine

$$10x(TC-FC)=BPC$$



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Protens Hydrogen (pH)

- Negative log of the hydrogen ion concentration
- Ideal pH for pool chemistry
 - 7.2-7.4
- Tears have a pH of 7.5
 - Ideal pH for bather comfort 7.4-7.6
- Acceptable pH for pools/spas
 - 7.2-7.8



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pH Range vs. Chlorine Effectiveness

- pH 7.2 – 7.8
 - At pH 7.2 – 80% HOCl + 20% OCl-
 - At pH 8.0 – 20% HOCl + 80% OCl-



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Total Alkalinity (80-120 PPM)

- Measure of water's ability to resist changes in pH



Bicarbonate + Carbonate + Hydroxide

- Low Total Alkalinity (pH unstable)
 - Add sodium bicarbonate
- High Total Alkalinity (pH very stable)
 - Add an acid (muriatic or sodium bisulfate)



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Total Dissolved Solids (TDS)

- Soluble matter in the water
- The longer the water is kept the higher the TDS level
- A high TDS level can mean a high organic contamination level
- No more than 1500 PPM higher than start up level of pool



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Cartridge Filters

- At least one replacement
- Backwashed or cleaned as recommended by manufacturer
- Inspected weekly



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Granular Filters

- Backwashed daily
 - Not by pressure differentials
- Inspected monthly
- Sedimentation Test
- Media replaced every 6 months



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Backwashing Filters

- Can be automatic start but not automatic stop
 - Water must be clear at stop



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Monthly Inspection and Sedimentation Test

- Backwash filter
- Stop pump(s)
- Drain water from filter
 - Inspect filter for cracks, holes, or mounds
- Collect core sample
 - Using appropriate tool
- Place filter media in clear jar with water
- Shake and let settle for 30 minutes
- Check for excessive organic material



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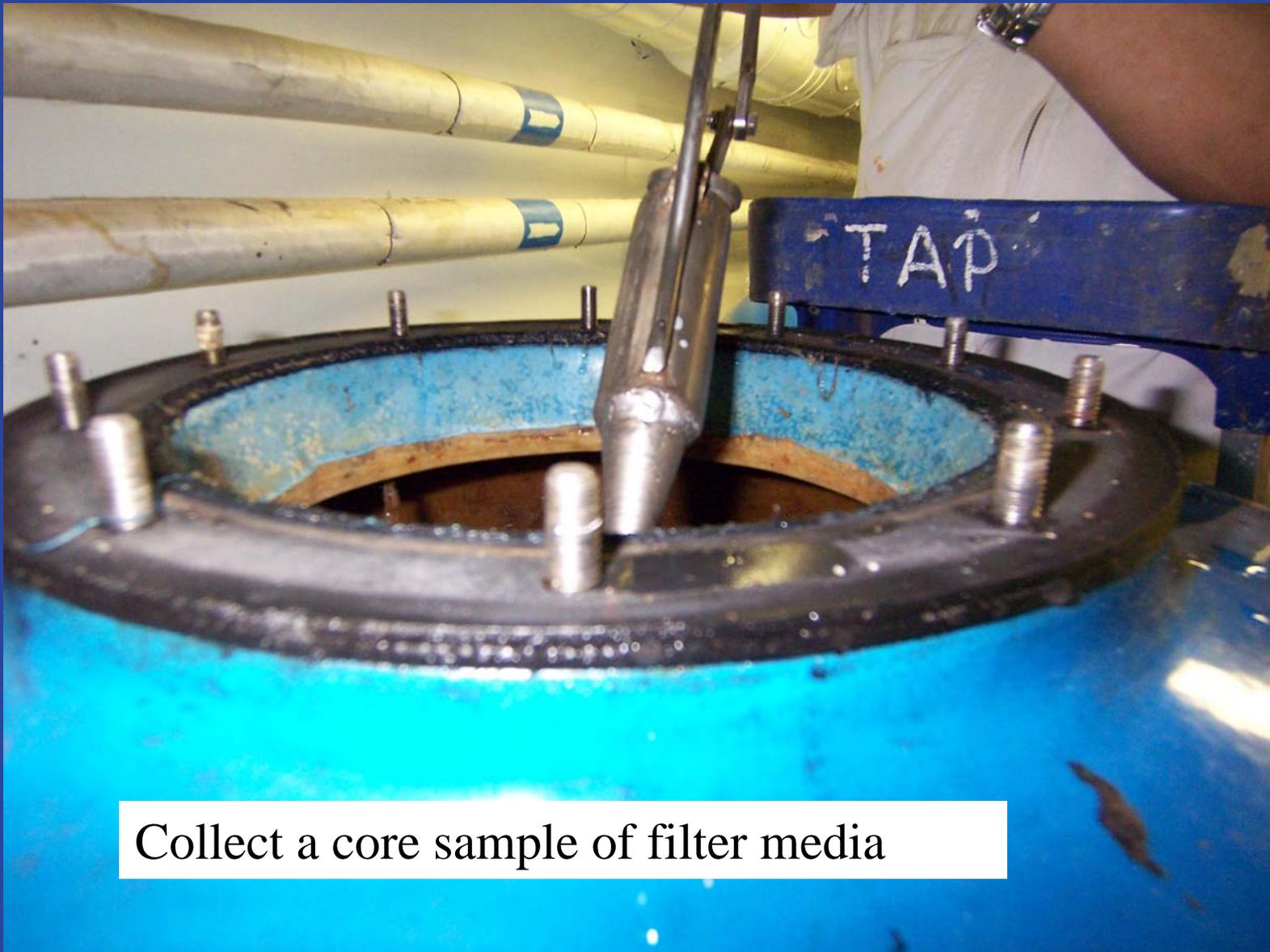
Drain water in filter housing and inspect uniformity of sand



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Collect a core sample of filter media



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Place sample in clear jar



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Add water and shake. Leave for 30 minutes to settle.



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Daily Shock Treatment

- Raise halogen residual to 10 PPM
- Circulate for 1 hour
- Discharge to waste
- Maintain record
 - Seawater whirlpools exempt as Legionella does not grow well in seawater



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Whirlpool Signs and Markings



- Risks
- Precautions
- Immunocompromised



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Temperature Setting

- Maximum temperature
– 40° C (104° F)

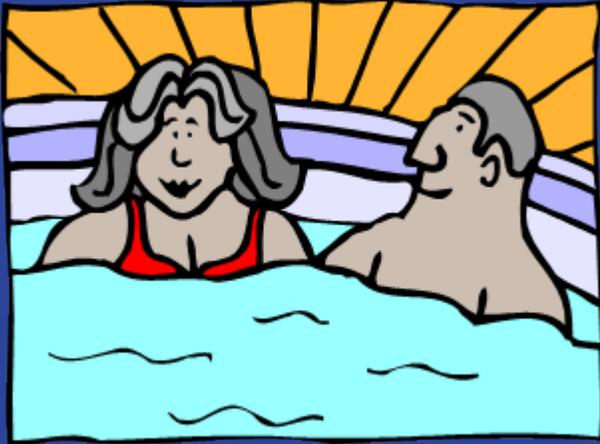


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Pools and Whirlpools



- Anti-entrapment (anti-vortex) drain covers

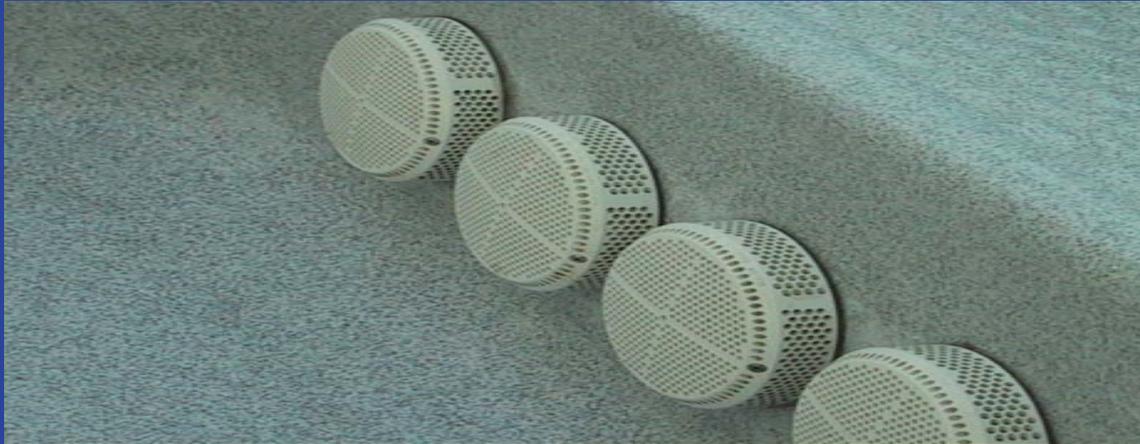


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Anti-entrapment Drain Covers



- Cover should be stamped with approval organization and maximum flow rate
- Letter attesting to covers meeting ASME/ANSI A 112.19.8M or equivalent standard can be substituted for stamp



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It's not just main drains that need to be anti-entrapment



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Improperly installed, missing fasteners or damaged covers are not anti-entrapment even if stamped or certified.



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Is this installation okay?



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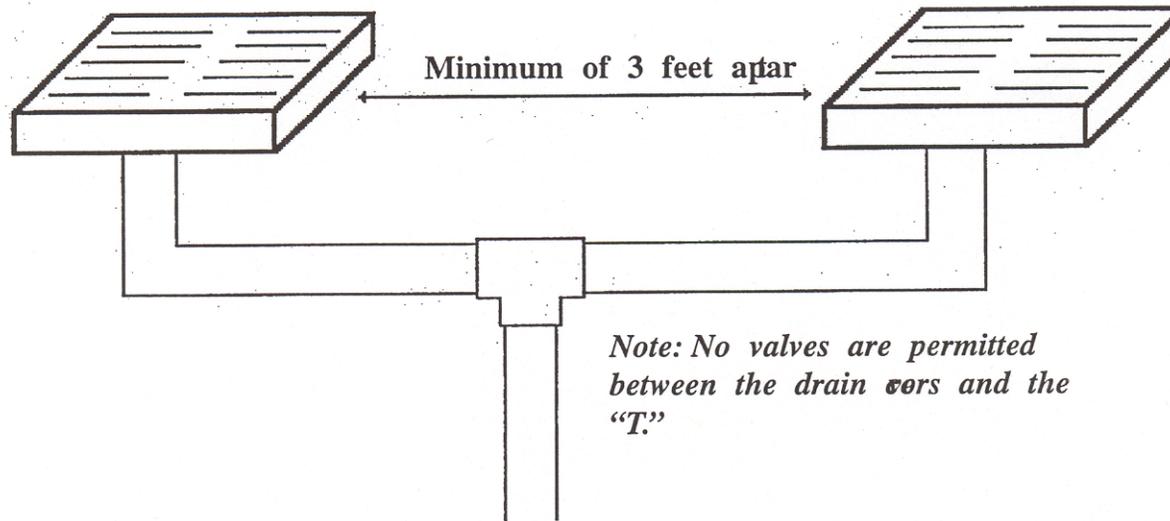
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Multiple Drain Systems

Guidelines for Entrapment Hazards: Making Pools and Spas

FIGURE 4a. Dual Drain System



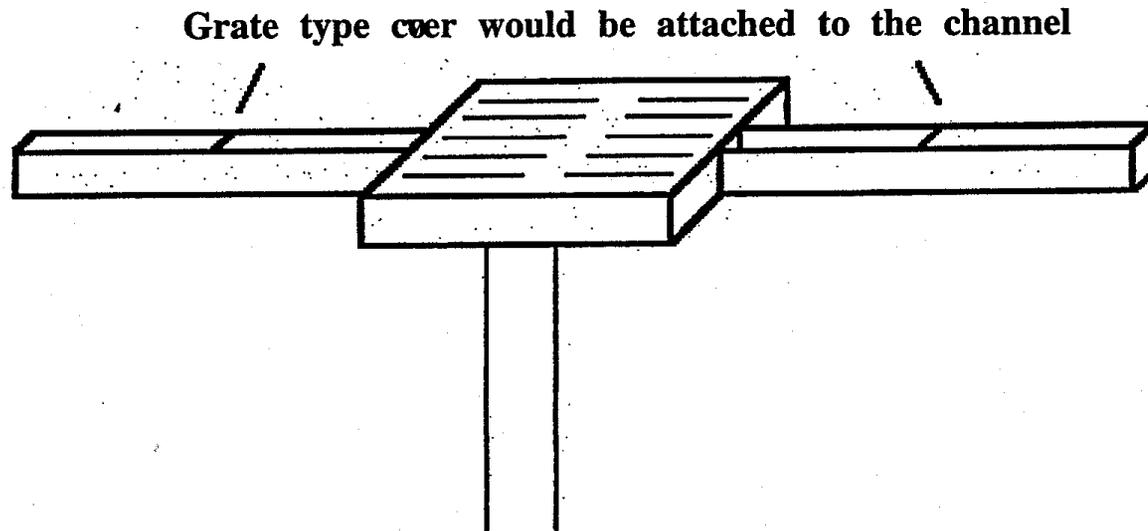
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Channel Drain System

FIGURE 4b. Channel System



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Pools and Whirlpools



- Fecal accident procedure



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Fecal Accident Procedure

- $CT = \text{_____ppm} \times \text{_____ minutes}$
 - Formed stools
 - $CT=45$
 - Loose stools, diarrhea
 - $CT=9600$



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Diaper Restrictions

Children in diapers or who are not toilet trained are not permitted in swimming pools or whirlpool spas



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Resources and References

- www.cdc.gov
- www.epa.gov
- www.cpssc.org



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