## Potable Water

## Environmental Health in Disaster Events

## Introduction

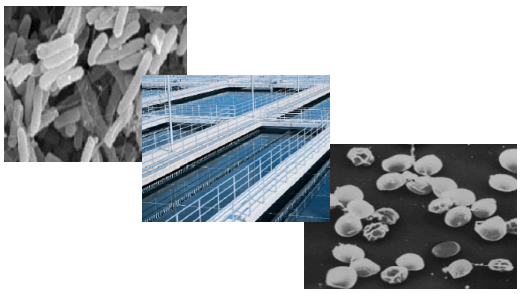
- Injury prevention and safety
- Environmental systems
- Water systems, assessments, and surveys
- Safe water in emergencies
- Water disinfection
- Water sampling

## Learning Objectives

By the end of this module participants will

- Increase understanding of water issues faced in disasters
- Increase understanding of the role of environmental health practitioners in addressing water issues
- Be able to identify key response partners
- Increase understanding of the basic components of systems
- Practice and demonstrate basic skills related to water issues
  - Common tests, sampling, treatment, assessment
- Identify key messages for the public and response partners

## Why Do Disaster-Related Waterborne Outbreaks Not Occur in the United States?



## Environmental Health Functions

- Ensure adequate supply of safe water is available to the public
- Prevent waterborne diseases
- Provide information on water safety and supply
- Conduct interventions needed for food service and other industries

## Reasons for Concern

- Aging water and wastewater infrastructure
- Population growth
- Frequency of natural disasters
- Terrorism threats
- Well construction oversight

## Impact on Water Supplies

- Source water contamination
- Physical damage
  - Treatment plants
  - Distribution pipes
  - Wells
- Workforce affected



## Key Partners

- Emergency management agency
- State and local departments of environmental quality, protection, health
- Public works and water purveyors
- Volunteer and community organizations
- Water haulers
- Emergency Support Functions (ESF)
  - 3, Public Works and Engineering
  - 6, Mass Care
  - 8, Health and Medical
  - 10, Oil and Hazardous Materials
- Industry
- Media

## Roles

- Assessment
- Consultation
- Environment monitoring
- Public information
- Preparing
- Leadership
- Planning
- Support activities
- Liaison activities

## Priority Activities

- Determine whether water service or quality has been affected
- Ensure adequate lab capacity
- Interpretation of sample results
- Assist water system operators if requested
- Distribute emergency water supplies
- Ensure emergency water supplies are safe
- Provide information on water needs, rationing, storage, disinfection
- Monitor emergency water supplies

## Injury Prevention and Safety

## Safety Is Job #1

- Personal sanitation
- Electrocution
- Carbon monoxide
- Musculoskeletal hazards
- Thermal stress
- Structural instability
- Hazardous materials
- Confrontations
- Fire
- Drowning, mechanical
- Personal protective equipment – use it!
- Driving, animals, insects, slips/falls
- Stress, fatigue
- Confined spaces – must be trained


## Interrelated Environmental Systems


## Water Systems, Assessments and Surveys

## Water Supply Assessment
Important Considerations

Quality (Prevention of waterborne illness)
- Hepatitis A, Norovirus, E. coli, Salmonella, Cryptosporidium, etc.

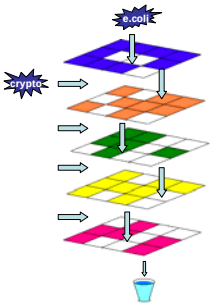
Quantity (Prevention of water-washed infections)
- Skin and eye infections, louse-borne typhus, Shigellosis

Coverage
- Access to safe water for 100% of users

Continuity
- Safe water 24/7

Cost
- Reasonable

## Water System Protections




**SOURCE**

**TREATMENT SYSTEM**

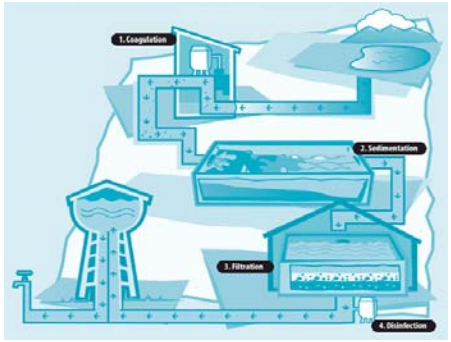
**DISTRIBUTION/TRANSPORT**

**STORAGE**

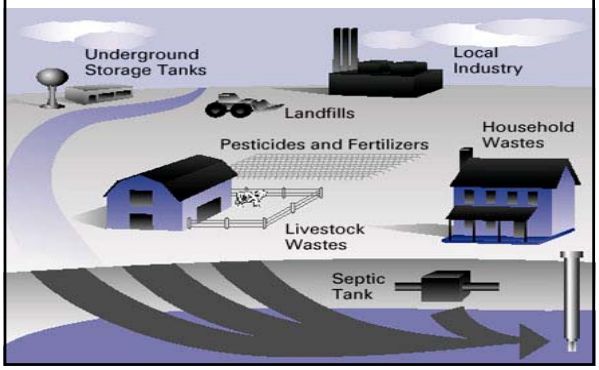
**POINT OF USE**

**WATER QUALITY**

## Water System - Public



## Threats to Groundwater




## Well Contamination?

## Other Drinking Water Contamination Sources


Pesticides/Fertilizers


Cattle Dipping Vats


CAFOs

Hazardous Waste Sites


Landfills


Spills/Leaks/Derailments

## Water Protection: Pressure Loss

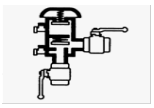
- Cross Connection
- Back Flow
- Back Siphonage

## Water Protection: Pressure Loss

- Backflow Preventer
- Air gap
- Reduced Pressure Backflow Assembly (RPBA)

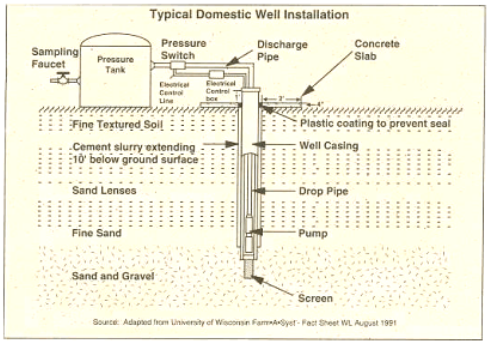

## Water Protection: Pressure Loss

- Pressure Vacuum Breaker (PVB)



- Double Check Valve (DCVA)

## Private Water Systems

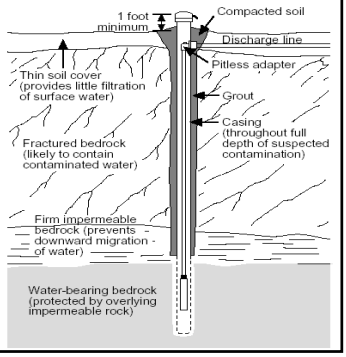



## Typical Drilled Well Finished in Bedrock

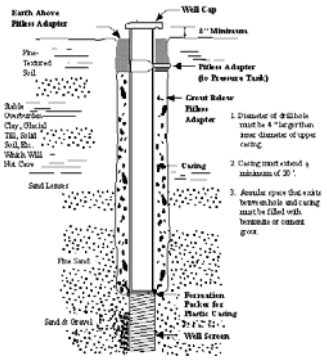
Well casing must be at least 40 feet below surface grade and at least 10' into bedrock

Full-length grouting show here

Courtesy of Iowa State Extension Service




## Illustration A - Proper Well Construction Unconsolidated Formations



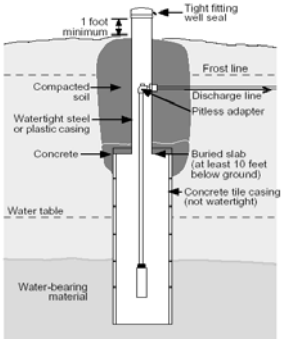

## Bored/Augured Well Construction

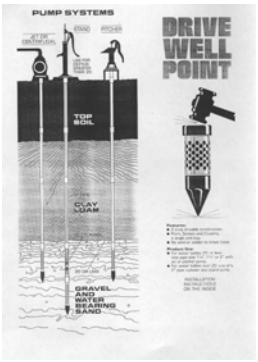
"Buried slab" style of bored well construction using a concrete or bentonite seal

Buried slab should be a minimum of 10' below surface grade

Precast concrete well curbing/tile stacked on top of each other, which act as the well casing

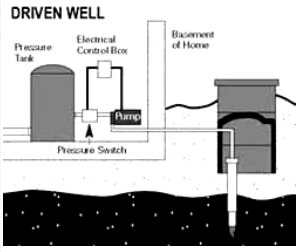
Courtesy of Iowa State Extension Service



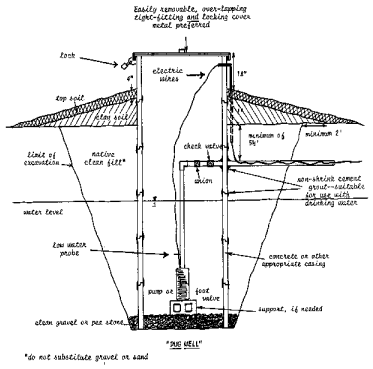




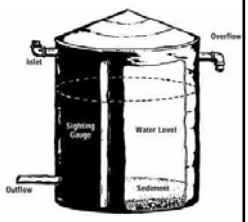



## Dug Wells

## Construction of Dug Well for Drinking Water

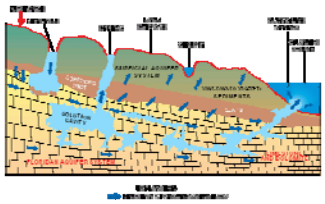



## Cisterns




## Springs

Springs in Groundwater Structures



## Environmental Health Water Surveys: Points to Consider

- Remember: SAFETY FIRST
- Primacy agency or EOC have own priority list
- Priority systems: large community, community, nontransient and transient noncommunity systems
- Agencies, other utilities, RWAs coexist in field
- Contract operators can be slow to visit systems

## EH Water Surveys: Action Steps

- Get maps and data from primacy agency (GPS - extremely helpful!)
- Contact the lead operator or owner
- Send inspectors into damaged areas
- Rapid information is critical first step
- Detailed survey information follow-up
- Rapid impact assessment reports

## Environmental Assessment Procedures

- Rapid field assessment
  - Water sources and supplies
  - Sewage management practices and other sources of contamination
  - Recent and historical water quality data
  - Water samples

**Rapid Damage Assessment Form**

Date: _____ Time: _____ Pictures Taken? Yes __ No __

Water Installation ___ Wastewater Installation ___ Treatment Facility ___

Plant Facility Name: _____

Address or Location: _____

Person Making Report: _____

| | | |
|---|---|---|
| 1. Power Supply | Line Power Condition: Power is On ____ Power is Off ____ (if Line Power is On Skip to #2) | |
| | Are there visible damages to overhead lines? | Yes __ No __ |
| | Are line fuses open? | Yes __ No __ |
| | Are there trees or limbs visible on electrical lines? | Yes __ No __ |
| | Is the service line to electrical cabinet damaged? | Yes __ No __ |
| 2. Flooding | Is the facility accessible? | Yes __ No __ |
| | Is the facility under water? | Yes __ No __ |
| | Is there evidence of inundation (high water marks)? | Yes __ No __ |
| 3. Electrical Status | Is there a generator on-site? | Yes __ No __ |
| | Is generator operating? Comments: _____ | |
| | Is the electrical panel damaged? | Yes __ No __ |
| | Is SCADA equipment operable? | Yes __ No __ |
| | Are there any breakers tripped inside panel? | Yes __ No __ |
| | Number of pumps on-site ___. Are all operational? | Yes __ No __ |
| 4. Other Damages | Are piping systems functioning? | Yes __ No __ |
| | Is there evidence of spills or other reportable activity? | Yes __ No __ |
| 5. Comments: | For recording Comments, for your explanation of any Box checked "Yes," and for recording you Field Notes, use the back of this sheet. | |

**RIAT Drinking Water / Wastewater Facility Report**

ESF 10 (DEP) & ESF 3 (Public Works & Engineering)

(Revision 07/04A)

– Verify Revision Prior to Transmitting Data –

**A: RIAT Data**

| 1. Team # | 2. Name: | 3. Date/Time: |
|---|---|---|

**B: Facility Type**

| 1. Public Water System (PWS) | 2. Waste Water Treatment Plant (WWTP) |
|---|---|

**C: Facility Data**

| | |
|---|---|
| 1. FDEP I.D. # | |
| 2. Pop Served or Capacity: | |
| 3. Municipality: | |
| 4. Street Address: | |
| 5: Facility Phone Number: | |
| 6: Facility Contact Person: | |
| 7: Latitude / Longitude: | |
| 8: Critical Facility Map I.D. # | |

**D: Facility Status**

| | | | |
|---|---|---|---|
| 1. Accessibility: | a. Good | b. Poor | c. Inaccessible |
| 2. Plant Integrity: | a. Minor Damage | b. Major Damage | c. Destroyed |
| 3. Distribution/Collection System: | a. Minor Damage | b. Major Damage | c. Destroyed |
| 4. WWTP | a. Overflow | b. Bypass | c. Estimate |
| 5. Hazmat Potential: | a. High | b. Low | c. None |
| 6. Man Power: | a. Adequate | b. Marginal | c. None |
| 7. Commercial Power: | a. Yes | b. No | c. Intermittent |
| 8. Auxiliary Power: | a. Available | b. None | c. Fuel Needed |
| 9. Potable Reserve: | a. Yes | b. No | c. Estimate |
| 10. Estimated Recovery Time: | a. Hours | b. Days | c. Weeks |

## Environmental Health Water Surveys

- General: access, power, staffing
- Wells: electrical, flood damage, flow
- Pumps: power, damage, flow/pressure
- Treatment: chemicals available, injectors, process damage, debris
- Storage: vents, damage, leaks
- Distribution: pressure*, leaks, zones
- Lab: functioning, equipment, hazmats
- Communication

## Conducting Rapid and Detailed Damage Assessments

- Compile rapid assessment info
- Categorize into power outage and facility damage
- Determine extent of power outage and prognosis for power recovery
- Dispatch any unused portable generators to critical areas
- Dispatch skilled personnel to facility damage locations

## Conducting Rapid and Detailed Damage Assessments

- Complete detailed assessment form
- Develop status monitoring system (status board)
- Prioritize response plan according to critical needs
- Dispatch available in-house resources
  - Request outside assistance if needed

## Emergency Response and Preparedness

Water and Wastewater Agency Response Networks


Additional WARN Resources:

AWWA WaterWeek Article

AWWA Mainstream Article

Journal AWWA Article

WARN White Paper

Simple Mutual Aid Agreement

Update to Sample Agreement - 09/07

Joint Policy Statement

EPA EMAC Tip Sheet for Water Sector

EPA Water Sector Mutual Aid & Assistance Fact Sheet

WARN FAQ

WARN Status and Contacts by State

## Safe Water In Emergencies


## Water Exercise

- Prepare a draft PSA
  Include:
  - Recommendations for storing water for disaster events
  - Water sources in the home
  - Outdoor water sources
  - Who to contact with questions/concerns
  - Where to look for disinfection guidelines

## Preparedness in the Home

- Store one gallon per person per day (two-week supply)
- Store water in thoroughly washed plastic, glass, fiberglass, or enamel-lined metal containers

## Preparedness in the Home

- If you have water pressure, fill sanitized bathtub and sinks
- Commercially bottled water can be stored for 2 years without affecting quality and taste
- Home-bottled water should be replaced every 6 months

## Hidden Water Sources in Your Home

- Sources: hot water tank, water supply lines, ice cubes, toilet reservoir tank (not toilet bowl), water beds
- Any water from waterbeds should be used only for bathing
- Water from all other sources should be disinfected

## Emergency: Outdoor Water Sources

- Rainwater, streams, rivers, and other moving bodies of water
- Ponds and lakes
- Natural springs
- Swimming pools

IMPORTANT!

Disinfect water from these sources before drinking

Avoid water with floating material or bad odors

Distill saltwater

## Making Water Safe

- Boiling: best way to make water safe – rolling boil for 1 minute (under 5,000 ft)
- Chlorination, disinfection tablets (chlorine or iodine), hiking/camping filters (1/8 teaspoon or 8 drops per gallon)
  - Cryptosporidium forms oocysts, making disinfection difficult
- Distillation, reverse osmosis, and filtering

## Water Disinfection

- Municipal systems
- Hauled or bulk water
- Groundwater well

Drinking Water - Chlorine residual of not more than 2.0 mg/L or less than 0.2 mg/L

## Disinfection Principles

- Need three pieces of information

PPM goal

## Chlorine Disinfection Targets in Municipal Systems and Hauling Tanks

- Target (depending on holding time)
  - 50 ppm (California Environmental Health Disaster Field Manual)
  - 100–200 ppm (Handbook of Environmental Health)
  - 25–100 ppm (CDC)

## Levels of Disinfectant for Community Water Systems

- 4.0 mg/L* is maximum residual disinfectant level
- Minimum trace levels are required at points of distribution throughout the system

*4.0 mg/L is noted as free chlorine levels

## Community Water Systems

## Chlorine Products for Disinfection

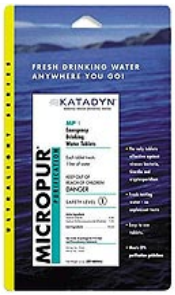
- Chlorine gas: 100%
- Calcium hypochlorite: 65% to 75%
- Sodium hypochlorite: 5.25% to 12.5%


## Chloramines

- More stable and longer lasting than free Cl
- Typically used for maintaining disinfectant residual*= longer disinfectant rate
- Lower concentrations of disinfection by-products
- More pleasing aesthetics, i.e., less taste, less odor

*4.0 mg/L is max residual disinfectant level
www.epa.gov/region9/water/chloramine.html

## Water Disinfection Tablets




## Hauled Drinking Water

- Large private (business) water systems
  - Source of water (treatment plant vs. hydrants)
  - Manifests showing source, disinfection test results
  - Storage tanks & hauling trucks: food grade?
  - Rechlorinating inside lodging facilities

## Unapproved Tankers

# Disinfection Exercise

## Disinfection Principles

- Bleach, 5.25%:
- 1% solution = $\frac{\text{1 g solute}}{\text{100 mL solvent}}$ = 52,500 mg Cl/L

$$5.25\% = \frac{5.25\text{ g Cl}}{100\text{ mL}} \times \frac{1{,}000\text{ mL}}{1\text{ L}} \times \frac{1{,}000\text{ mg}}{1\text{ g}}$$

## Disinfection Principles

Scenario:

- 1,000 gal hauling tank
- Target = 50 ppm
- Bleach, 5.25%

## Disinfection Principles

- Calculate total Cl needed:
- $1{,}000\text{ gal} \times \frac{3.78\text{ L}}{1\text{ gal}} \times \frac{50\text{ mg Cl}}{1\text{ L}}$

= 189,000 mg Cl

## Disinfection Principles

- Bleach, 5.25%:
- 1% solution = $\frac{\text{1 g solute}}{\text{100 mL solvent}}$
- $5.25\% = \frac{5.25\text{ g Cl}}{100\text{ mL}} \times \frac{1{,}000\text{ mL}}{1\text{ L}} \times \frac{1{,}000\text{ mg}}{1\text{ g}}$

= 52,500 mg Cl/L

## Disinfection Principles

- Calculate amount of bleach needed:

$$= \left(\frac{189{,}000\text{ mg Cl}}{52{,}500\text{ mg Cl}}\right) \text{ 1 L}$$

$$= 3.6\text{ L} \times \frac{1\text{ gal}}{3.78\text{ L}} = 0.95\text{ gal} \approx 1\text{ gal}$$

## Water Volume

For well or pipe capacity

- www.pages.prodigy.net/rich_demartile/files/pipe-vol.xls

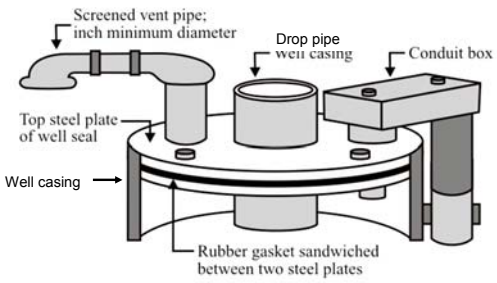
For circular and rectangular tank volume

- www.sterilex.com/toolscalc.htm

## Well and Pump Inspection

- **Flood conditions at the well:** flood water can carry large debris that could loosen well hardware, dislodge well construction materials, or distort casing
- **Electrical system:** do not turn on equipment until the wiring system has been checked by a qualified electrician, well contractor, or pump contractor
- **Pump operation:** pump (including valves and gears) will need to be cleaned of silt and sand

## Well Seal




## Pumps

## Video Presentation

**Well Disinfection**

## Chlorine Dosage

| Water* | Desired Chlorine Concentration in Miligrams per Liter (mg/L) 5.25 % Household Bleach | | | | | |
|---|---|---|---|---|---|---|
| | 1 | 5 | 25 | 50 | 100 | 200 |
| 5,000 | 13 fl oz (1-1/2 cups) | 61 fl oz (7-3/4 cups) | 2-1/2 gal | 4-3/4 gal | 9-1/2 gal | 19 gal |
| 2,000 | 5.1 fl oz (1/2 cup) | 24 fl oz (3 cups) | 1 gal | 2 gal | 3-3/4 gal | 7-1/2 gal |
| 1,000 | 2.6 fl oz (1/4 cup) | 13 fl oz (1-1/2 cups) | 61 fl oz (7-3/4 cups) | 1 gal | 2 gal | 3-3/4 gal |
| 500 | 1.3 fl oz (1-1/2 tbsp) | 6.4 fl oz (3/4 cup) | 31 fl oz (3-3/4 cups) | 61 fl oz (7-3/4 cups) | 1 gal | 2 gal |
| 200 | 0.5 fl oz (1/2 tbsp) | 2.6 fl oz (1/4 cup) | 13 fl oz (1-1/2 cups) | 24 fl oz (3 cups) | 49 fl oz (6 cups) | 97 fl oz (12 cups) |
| 100 | 0.25 fl oz (1-1/2 tsp) | 1.3 fl oz (1-1/2 tbsp) | 6.4 fl oz (3/4 cup) | 13 fl oz (1-1/2 cups) | 24 fl oz (3 cups) | 49 fl oz (6 cups) |
| 50 | 0.13 fl oz (3/4 tsp) | 0.6 fl oz (1-1/4 tbsp) | 2.6 fl oz (1/4 cup) | 6.4 fl oz (3/4 cup) | 13 fl oz (1-1/2 cups) | 24 fl oz (3 cups) |
| 25 | 0.06 fl oz (5/8 tsp) | 0.25 fl oz (1-1/2 tsp) | 1.3 fl oz (1-1/2 tbsp) | 2.6 fl oz (1/4 cup) | 6.4 fl oz (3/4 cup) | 13 fl oz (1-1/2 cups) |
| 10 | 0.03 fl oz (1/4 tsp) | 0.13 fl oz (3/4 tsp) | 0.6 fl oz (1-1/4 tbsp) | 1.3 fl oz (1-1/2 tbsp) | 2.6 fl oz (1/4 cup) | 5.1 fl oz (1/2 cup) |
| 5 | 0.01 fl oz (1/8 tsp) | 0.06 fl oz (3/8 tsp) | 0.25 fl oz (1-1/2 tsp) | 0.6 fl oz (1-1/4 tbsp) | 1.3 fl oz (1-1/2 tbsp) | 2.6 fl oz (1/4 cup) |

## Well Depth

- Average of well depths in area
  - Determined in advance?
- Measure depth?
  - A rule of
  - "Put a gallon of bleach in the well"???

(Discussion)

## Cistern Disinfection Steps

- Thoroughly clean the catchment area (rooftop) and remove all debris
- Drain cistern completely
- Without entering tank, scrub the inside with a stiff brush or broom and solution of 1 cup (8 oz.) 5.25% unscented bleach in 10 gallons of water
- Refill cistern with rainwater or potable water
- Add 4 cups (32 oz.) per 100 gallons in the cistern (~100 ppm)

## Cistern Disinfection Steps

- Run water through all home plumbing until you smell chlorine
- Let solution sit undisturbed for 24 hours
- Drain cistern completely
- Refill tank naturally or with potable water
- Flush all plumbing until chlorine odor is gone

## Well Abandonment

- Wells that have been damaged beyond repair must be properly abandoned to prevent groundwater contamination

## Well Abandonment

Drilled wells (*check state guidelines)

- Remove pumps, piping, conduit, wiring, and any other obstructions
- Calculate water volume and disinfect well by adding chlorine at 0.5 oz/100 gal (65% $Cl_2$) or 7.0 oz/100 gal (5% $Cl_2$)
- Inject neat cement or bentonite grout into well, filling from the bottom to the top
- If using bentonite, fill the top 10 feet of casing with cement or concrete
- Fill to top of casing to create a concrete/cement plug

## Well Abandonment

Bored wells (*check state guidelines)

- Remove plumbing, piping, and obstructions
- Calculate water volume and disinfect well by adding chlorine at 0.5 oz/100 gal (65% $Cl_2$) or 7.0 oz/100 gal (5% $Cl_2$)
- *Remove as much casing as possible
- Remove soil and other subsurface material to a depth of 3 feet and at least 1 foot wide around remaining casing
- Fill well to top of casing with cement, concrete, or bentonite grout
- Pour 1-foot-wide cement or concrete plug to ground surface around well casing

# Water Sampling

## Proper Sample Collection Techniques and Procedures

- Before sampling, have all of your supplies on hand, including:
  - Cooler for shipping and storage of sample
  - Ice for shipping cooler
  - PVC or Neoprene gloves
  - 125 mL sample bottle with sodium thiosulfate for chlorinated systems
  - Lab slips, labels, and markers
- Additional recommended items
  - Paper towels for drying off sample container
  - Plastic storage baggies for ice and sample container

## Sample Collection (continued)

- Sampling containers
  - 125 mL sterilized plastic bottles most common
- Avoid using damaged sample containers
- Collecting a clean sample
  - Wash hands
  - Avoid smoking, eating
  - Adhere to good sampling collection practices

## Proper Sampling Techniques, TCR Coliform and *E. coli*

1. Sampling site selection
   - Approved sampling location as designated by your approved sampling site plan
   - Proper design of sampling faucets and/or specially installed sampling taps
2. Remove any aerator, strainer, or hose
3. Optional steps
   - Some sampling practices involve spraying the tap with a chlorine solution, or even flaming the tap

## Proper Sampling Techniques (continued)

4. Turn on cold water and flush tap for 2–3 minutes
   - Reduce flow (no greater than ¼-inch diameter)
   - While water is running, fill out labels, tags, and laboratory forms
   - Apply labels to the container
   - Test for both chlorine and water pH; enter the results on your lab slip
5. Carefully remove the bottle cap: touch only outside surfaces
   - Position the bottle under the water flow
   - Hold the bottle in one hand and the cap in the other.
   - Fill bottle to about ¼ inch from the top or the 100-mL fill line

## Proper Sampling Techniques (continued)

7. Cap sample container tightly
   - Blot sample container dry
   - If iced and shipped, bag separately to avoid contamination of the sample
8. Turn tap off; replace aerator, strainer, or hose
9. Check for correct label information
   - Check the laboratory form and attach it to the bottle with a rubber band; complete all additional laboratory forms
   - Follow lab instructions

## Proper Sampling Techniques (continued)

IMPORTANT:

- Analysis must begin within 30 hours of collection.
- Samples should be refrigerated or cooled to below 10° Celsius (50° Fahrenheit).
- Use ice packs; deliver the samples if lab is close by
- If using overnight courier
  - Tape the chest before shipping
  - Bag samples and ice separately
  - Copy forms if possible

## Exercise

## Water Sampling Equipment

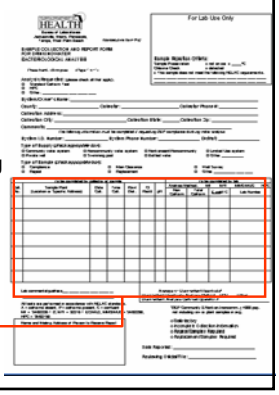
## Lab Test

- The most common test (Colilert) uses a reagent that changes color and/or glows, depending on the organisms present
  - Clear for no growth
  - Yellow for total coliforms only
  - Fluorescence for *E. coli*

## Fluorescence

## What You See

- Lab results form
  - Contain things such as
    - System ID
    - Date and time of sampling
    - Sampling type
    - Reason for sampling
- Bacterial results appear here on this form



## How to Interpret the Form

- In the example below
  - Sample 1 tested negative for both organisms
  - Sample 2 had total coliforms present
  - Sample 3 had both total and fecal coliforms present (fecal=acute MCL violation)

| *To be completed by collector of sample* | | | | | | | *To be completed by lab* | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | Analysis Method: | MF | MTF | MMO-MUG HPC |
| Coll. No. | Sample Point (Location or Specific Address) | Date Coll. | Time Coll. | Raw/ Dist. | Cl Res'd | pH | Non Coliform | Total Coliform | E.coli/FC | Lab Number |
| 1 | Well | 2/7/04 | 12:45 | R | 0.0 | 7.1 | | A | A | 05-00101 |
| 2 | Tap 1 | 2/7/04 | 13:00 | D | 0.7 | 7.2 | | P | A | 05-00102 |
| 3 | Tap 3 | 2/7/04 | 13:15 | D | 0.8 | 7.1 | | P | P | 05-00103 |

## How to Interpret the Form

- Sample 1 (well)
  - No further action needed
- Sample 2 and 3 (taps)
  - Both sites are unsatisfactory, can be declared unfit to drink, and will need to be resampled
  - This resampling should be done according to SDWA Total Coliform Rule sampling plan or other emergency guide

## Maximum Contaminant Levels

- Each organism has its own MCL*
  - Total coliforms
    - A MCL violation = present in any compliance sample **and** repeat sample
  - Fecal coliforms
    - A MCL violation = present in any compliance **or** repeat sample
      - **Also**, coliforms must be present in repeat sample

*MCL=Maximum Contaminant Level

## Coliform Occurrence

- Treatment breakthrough
- Source positive
- Disinfection failure
- Filter malfunction
- Open storage
- Residual maintenance
- Regrowth
- Intrusion
- Cross connection
- Backflow
- Main repairs
- Main breaks
- Colonization

Marie-Claude Besner, et al. *AWWA Journal*, August 2002

## Coliform Survival/ Growth Variables

- Water temperature
- Disinfection type and residual
- Pipe corrosion and corrosion control
- Debris accumulation
- Nutrients, AOC, BOM
- Hydraulics, residence time

Marie-Claude Besner, et al. *AWWA Journal*, August 2002

## Disaster Boil Water Notices

- Preparation before disaster is critical
- Water systems and public need advice
- Agencies need to coordinate issue/rescind
- Ready for overlapping jurisdictions

## Before Boil Water Notice

- Preparation before disaster is critical
- Letters to all public water systems instructing them of regulatory duties and liabilities long before event
- Provide agency emergency contact lists
- Rule requirements take time; are useful
- Public outreach info from PWS and agencies before event
- Media outreach materials, before and after

## Before Boil Water Notice

- Coordination with food regulators, food service, and processors before event
- Planning for critical medical (hospitals, dialysis)
- EOC/ESF-8 briefings at state and county
- Web post media/public info year round
- Discuss with and train all environmental staff

## What To Expect During A Boil Water Notice

- Expect power loss in impacted area; therefore communication gaps for days +
- Expect bottled water to be primary source for most people
- Expect deviations from the boil water notice protocols
- Public water systems may not abide by BWN guidelines; mayors, commissioners, administrators, water plant supervisors, owners will take charge to shortcut bureaucracy, usually with safe results

## What To Expect During A Boil Water Notice

- Limited media info to the public afterward
- Comfort stations, shelters, and other official aide sites may be best information outreach locations
- Not all needed persons will be available due to damage or other reasons (especially weekends)
- Larger utilities are fairly self sufficient – often have mutual aid compacts with other jurisdictions
- This is not true for small systems - contract operators may be overwhelmed or unavailable

## Boil Water Notice: Issue/Rescind

- BWN can be issued by PWS, health authority, primacy agency, EOC
- Should be lifted by issuing agency only after
  - repairs are completed
  - adequate pressure throughout system
  - safe residual chlorine throughout system
  - low turbidity (esp. for surface water)
  - satisfactory bactis, number based on needs
  - can be lifted in hydraulically discernable areas

## Fuel and Other Chemical Contamination

## Fuel/Chemical Sampling

After floods, if fuel or chemical contamination is probable, lab tests are warranted for:

- Total petroleum hydrocarbons (EPA 503.1)
- Benzene, toluene, ethyl benzene, xylene
- Volatile organic compounds (VOCs) (EPA 502.1, 524.1)
- Pesticide scans (EPA 504, 505)
- Metals: lead
- Inorganics: arsenic

## Organic Samples

Volatiles will escape if aerated during sampling process

- Remove aerator from spigot
- Run water at least 5 minutes
- Hold bottle at angle to reduce aeration
- Fill bottle completely
- Invert bottle to check for bubbles
- If bubbles are present, pour out and retake sample
- Self deliver or send overnight mail

## References


- American Water Works Association; Water and Wastewater Agency Response Networks - http://www.awwa.org/Government/Content.cfm?ItemNumber=3837&&navItemNumber=3838
- CDC / HUD Healthy Housing Reference Manual: http://www.cdc.gov/nceh/publications/books/housing/housing.htm
- CDC's Emergency Preparedness and Response; Natural Disasters & Severe Weather site - www.bt.cdc.gov/disasters
- City of Pensacola; Post-Disaster Recovery and Redevelopment - http://escambia-emergency.com/Local_Mitigation/LMSdraftupdate/E-MitigationPlan/CityofPensacolaPostDisaster/PostDisasterRedevelopment.pdf
- EPA - Private Drinking Water Wells: Drilled Wells - http://www.epa.gov/privatewells/basic_drilled.html
- EPA Region IX: Chloramines www.epa.gov/region9/water/chloramine.html


## References


- EPA's Ground Water and Drinking Water; Emergency Disinfection of Drinking Water site – www.epa.gov/safewater/faq/emerg.html
- Florida Department of Health - http://www.doh.state.fl.us/
- For circular and rectangular tank volume www.sterilex.com/toolscalc.htm
- Inspectapedia; Groundwater Pollution Sources of Drinking Water from Household Wells - http://www.inspect-ny.com/water/EPADrink.htm
- Missouri Department of Health and Senior Services; Disinfection of Contaminated Wells and Cisterns - http://www.dhss.mo.gov/Lab/EnvBact/Lab-10D.pdf


## References


- National Rural Water Association: http://www.nrwa.org/
- Public Health; Seattle & King County Drinking Water Program: Springs -
- http://www.metrokc.gov/health/water/springs.htm
- University of South Florida Private Inspectapedia: www.bt.usf.edu
- Volume Calculator for well or pipe capacity - http://pages.prodigy.net/rich_demartile/files/pipe-vol.xls

FEMA

CDC

# Questions?