26th Annual Cross-Connection Control Conference

Global Solutions in 2016

System Flushing & It's Hazards

Presented by:
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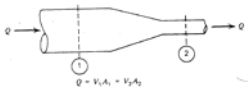
CHARLOTTE WATER

Pressure-Velocity-Head Relationships

Flow Equation for incompressible liquids

$$Q = V_1 \times A_1 = V_2 \times A_2$$

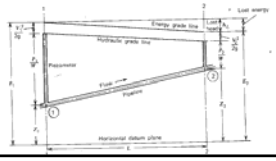
Q = quantity, cubic feet per second
V = velocity, feet per second
A = cross-sectional area of flow, square feet



Total Energy = Elev. Head + Pressure Head + Velocity Head

$$E = Z_1 + (P_1/w_1) + (V^2_1/2g_1) = Z_2 + (P_2/w_2) + (V^2_2/2g_2) + h_L$$

E = total energy head, feet
Z = elevation above datum, feet
P = pressure, pounds per square feet
V = velocity of flow, feet per second
w = unit weight of liquid, pounds per cubic foot
g = acceleration of gravity = 32.2 ft/(sec)^2
h_L = head loss, feet



CHARLOTTE WATER

Pressure-Velocity-Head Relationships

Association Between Quantity of Flow Velocity and Area

$$Q = V \times A$$

Q = quantity, cubic feet per second
V = velocity, feet per second
A = cross-sectional area of flow, square feet

Total Energy = Elev. Head + Pressure Head + Velocity Head

$$E = Z + (P/w) + (V^2/2g)$$

E = total energy head, feet
Z = elevation above datum, feet
P = pressure, pounds per square feet
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Pressure-Velocity-Head Relationships

Pipe head loss as a result of friction

$$h_L = f \times [(L \times V^2) / (D \times 2g)]$$

h_L = head loss, feet
f = friction factor for pipe
L = length of pipe, feet
V = velocity of flow, feet per second
D = diameter of pipe, feet
g = acceleration of gravity = 32.2 ft/(sec)^2

Unit head loss as a result of friction

$$h_L = (k \times V^2) / 2g$$

h_L = head loss, feet
k = friction factor for unit (valve, bend, etc.)
V = velocity of flow, feet per second
g = acceleration of gravity = 32.2 ft/(sec)^2

CHARLOTTE WATER

My objectives for this session are…

- Discuss the importance of flushing
- Point out some key things to consider when flushing
- Discuss unidirectional flushing
- Speak on concerns with premise plumbing
- Staff Safety
- System Operation and
- Communication

HOPEFULLY WE GET TO IT ALL!

Is this what you want out of this presentation?

CHARLOTTE WATER

WHY WOULD WE NEED A BACKFLOW PROGRAM?

To protect safe drinking water, plain and simple

WHY WOULD WE NEED TO FLUSH?

Maintain water quality

Remove sediments

Respond to system contamination

WHY WOULD WE NEED TO FLUSH?

Protect public health, plain and simple

ıe Charlotte Observer

WEDNESDAY, SEPTEMBER 3, 1997

Chemical leak taints water

Up to 29 schools may not open today

What to consider when you flush

- Why are you flushing
- Where are you flushing
- What will the flushing impact

Why are you flushing

- Taste and/or odor complaint
- Sampling parameter violation
- Scheduled flushing program
- Repair and Service Work
- Contamination

Where are you flushing

- **Identify**
- **Isolate**
- **Determine extent of impact**
- **Notification**
- **Decontamination**
- **Mitigation**
- **Documentation**

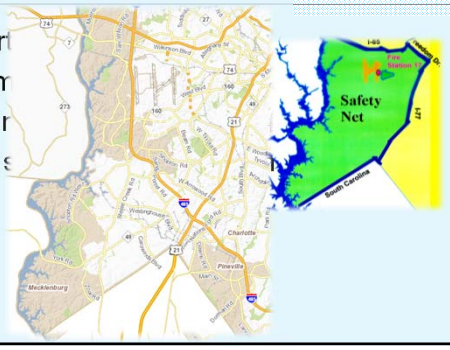
Charlotte's Contamination What Happened

- **Cross-connection made w/ fire hydrant**
- **240psi of foam water mix back flowed under back pressure into water system**
- **The cause: outdated equipment and human error**

Where are you flushing

What could flushing impact

- Proper
- Systen
- Enviror
- Water s



Premise Plumbing

- Old or outdated materials/new designs
- Non approved materials
- Cross connections
- Communicate activities
- Warn of possible pressure situations

What is unidirectional flushing

- Planned movement of water one pipe segment at a time
- Elevated velocities 6 to 10 ft/sec
- Benefits in asset management
- Consider the following in your program:
  - assess your assets
  - perform criticality analysis & fix issues
  - Create plan
  - Communicate plan
  - Execute plan
  - Document results

Staff Safety

- Ever had a FH cap blow off?
- Plan for the unexpected
- Use proper equipment and PPE
- Safeguard against pedestrian interference
- End of the day everyone goes home safe

System Operation

- Use system map
- Plan out process
- Communicate
- Pay attention to what's happening
- Repair any deficiencies or schedule it
- Document conditions as is and as left

REMMBER THE STEPS!

Identify
Isolate
Determine Extent
Notification
Decontamination
Mitigation
Documentation

Communication

- Sender and Receiver
- Get all the specifics up front
- Share info with group
- Share plan with all stake holder
- Maintain information updates
- Communicate debrief

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