

# Cross-Connection Control Program Specialist Expected Range of Knowledge

Approved by the Cross-Connection Control Program Specialist Certification Committee – 8/12/2003

**The Expected Range of Knowledge is a Foundation upon which the Specialist will build a strong professional capability.**

*NOTE:* This Expected Range of Knowledge is intended to provide a comprehensive outline of topics that should be known and understood by a prospective Cross-connection Control Program Specialist. As a certified Backflow Prevention Assembly Tester, the prospective Specialist should be proficient in the Expected Range of Knowledge for the Backflow Prevention Assembly Tester as well as the following. The prospective Program Specialist should refer to the Cross-connection Control Program Specialist Training Resource Listing to assist in acquiring the Expected Range of Knowledge.

## EXPECTED RANGE OF KNOWLEDGE

### Cross-Connection Control Program Specialist

#### 1. Introduction –

The Cross-connection Control Program Specialist should have an understanding of:

- 1.1 The history of Water Distribution Systems.
- 1.2 The history, causes, and effects of Cross-connections
- 1.3 The history of the methods of Backflow Prevention and Backflow Prevention Assemblies.

#### 2. Theory of Hydraulics and Theory of Backflow –

The Cross-connection Control Program Specialist should have a working familiarity with:

##### 2.1 Definitions - Hydraulics

- 2.1.1 Pressure including Absolute Pressure, Atmospheric Pressure, Gauge Pressure, and Negative Pressure (Vacuum).
- 2.1.2 Sources of Pressure including Static Head, Thermal Expansion, Pumps.
- 2.1.3 Head Loss.
- 2.1.4 Water Hammer.
- 2.1.5 Gradient.
- 2.1.6 Venturi Effect.
- 2.1.7 Rate of Flow.

##### 2.2 Calculations – Hydraulics

- 2.2.1 Water Column Height and resulting pressure.
- 2.2.2 Differential Pressure.

##### 2.3 Hydraulic Theory

- 2.3.1 The relationship between Absolute Pressure and Atmospheric Pressure.
- 2.3.2 The term Gauge Pressure and its relationship to Absolute Pressure.
- 2.3.3 The term Vacuum (Negative Pressure) and its relationship to Atmospheric Pressure and Absolute Pressure
- 2.3.4 Head Loss.
- 2.3.5 Static Pressure.
- 2.3.6 Thermal Expansion.
- 2.3.7 Water Hammer

##### 2.4 Definitions - Backflow Prevention

- 2.4.1 Backsiphonage and Backpressure.
- 2.4.2 Backflow.
- 2.4.3 Cross-connections (direct and Indirect).
- 2.4.4 Degree of Hazard.
- 2.4.5 Containment (Service) Protection.
- 2.4.6 Isolation (Internal) Protection.
- 2.4.7 Pollutants and Contaminants.

## 2.5 Backflow Theory

- 2.5.1 Backflow and list the conditions that can cause Backflow.
- 2.5.2 Cross-connections and the difference between an Indirect and a Direct Cross-connection.
- 2.5.3 Backsiphonage and the principle causes for its occurrence.
- 2.5.4 Backsiphonage due to Aspiration (Venturi Effect) in a closed piping system.
- 2.5.5 Backpressure and the principle causes for its occurrence.
- 2.5.6 The difference between the terms Contaminant and Pollutant.
- 2.5.7 Degree of Hazard and how the Various Degrees are determined.
- 2.5.8 Submerged Inlets to Plumbing Fixtures and the type of Backflow Condition that results.
- 2.5.9 The difference between Containment (Service) and Isolation (Internal) Protection.

## 2.6 Recycled Water, Gray Water, and Fire Systems

- 2.6.1 Potential hazards from Recycled Water Systems.
- 2.6.2 Potential hazards from Gray Water Systems
- 2.6.3 Potential hazards from Fire Systems.

### 3. Administration of Cross-connection Control Programs –

The Cross-connection Control Program Specialist should have a comprehensive understanding of the following:

#### 3.1 The Regulations and Codes relating to Cross-connection Control –

- 3.1.1 The Federal Safe Drinking Water Act.
- 3.1.2 State Regulations
  - 3.1.2.1 California Code of Regulations, Title 17, Sections 7583-7605.
  - 3.1.2.2 Nevada Administrative Code, - NAC 445-A.
  - 3.1.2.3 Applicable Plumbing Code(s):
    - 3.1.2.3.1 Uniform Plumbing Code.
    - 3.1.2.3.2 California Plumbing Code CCR, Title 24, Part 5.
    - 3.1.2.3.4 Nevada Plumbing Code.

#### 3.2 The Roles and Responsibilities of the following in Cross-connection Control and Preventing Backflow

- 3.2.1 Federal EPA (Safe Drinking Water Act Enforcement).
- 3.2.2 Health Agencies (State and Local).
- 3.2.3 Water Purveyor.
- 3.2.4 Cross-connection Control Specialist.
- 3.2.5 Plumbing Official (Administrative Authority).
- 3.2.6 Backflow Prevention Assembly Tester.
- 3.2.7 Consumer.

#### 3.3 The following terms as they pertain to Cross-connection Control

- 3.3.1 Administrative Authority.
- 3.3.2 Accessibility.
- 3.3.3 Approval.
- 3.3.4 Backflow due to Backpressure or Backsiphonage.

- 3.3.5 Critical Level
- 3.3.6 Gray Water.
- 3.3.7 Plumbing System.
- 3.3.8 Potable Water
- 3.3.9 Recycled (Reclaimed) Water.
- 3.3.10 Water Distribution Main.

#### 3.4 Cross-connection Control Programs

- 3.4.1 The Definitions of Laws, Regulations, Ordinances, Rules, Policies, and Procedures..
- 3.4.2 The Difference between “Approved” and “Listed –
  - 3.4.2.1 Listing Agencies.
  - 3.4.2.2 Approving Agencies.
- 3.4.3 The major provisions of a Water Supplier’s Cross-connection Control Program.
- 3.4.4 Internal Backflow Prevention Program.
- 3.4.5 Containment (Service Connection) Backflow Prevention Program.
- 3.4.6 The Water Supplier’s possible courses of action if a consumer fails to implement appropriate methods of Backflow Prevention.
- 3.4.7 Certification of –
  - 3.4.7.1 Cross-connection Control Program Specialist.
  - 3.4.7.2 Backflow Prevention Assembly Tester.
- 3.4.8 Record Keeping/Reporting –
  - 3.4.8.1 Test Reports:
    - 3.4.8.1.1 Physical identification of Backflow Assembly tested.
    - 3.4.8.1.2 Field Test Data.
    - 3.4.8.1.3 Tester identification.
    - 3.4.8.1.4 Retention of Test Reports.
    - 3.4.8.1.5 Failed assemblies.
  - 3.4.8.2 Improper installations.
- 3.4.9 Continuing Education.
  - 3.4.9.1 Industry Standards/Specifications.
    - 3.4.9.1.1 Plumbing Codes
    - 3.4.9.1.2 USC FCCC&HR Cross-connection Control Manual (Currently approved Edition).
    - 3.4.9.1.3 AWWA Manual M-14 (Currently approved Edition).
  - 3.4.9.2 Recommended Practice Manuals.
    - 3.4.9.2.1 Guidance Manual For Cross-connection Control Systems
  - 3.4.9.3 Organizations.
    - 3.4.9.3.1 USC FCCC&HR
    - 3.4.9.3.2 AWWA

#### **4. Cross-connection Control Survey –**

The Cross-connection Control Program Specialist should have a comprehensive understanding of the following:

- 4.1 The Purpose and Goal of the Cross-connection Control Survey –
  - 4.1.1 Identification of Cross-connections.



- 4.1.2 Hazard Assessment.
- 4.1.3 Identification of Appropriate Method(s) of Protection.
- 4.2 Plan Check when conducting a Cross-connection Control Survey
  - 4.2.1 Symbols Used on Drawings.
  - 4.2.2 Design Drawings.
  - 4.2.3 As-built (Record) Drawings.
  - 4.2.4 Isometric Drawings.
- 4.3 Cross-connections (Actual and Potential).
- 4.4 Problems associated with typical Fixtures and Water Using Equipment
  - 4.4.1 Common water connected equipment
    - 4.4.1.1 Boilers.
    - 4.4.1.2 Carbonators.
    - 4.4.1.3 Chemical Pot Feeders.
    - 4.4.1.4 Chemical Injection Systems
    - 4.4.1.5 Corrosion Control and other Chemicals.
    - 4.4.1.6 Soaps and Detergents.
    - 4.4.1.7 Fertilizers and Pesticides (chemigation).
    - 4.4.1.8 Chillers.
    - 4.4.1.9 Condensate Traps and other Heat Sinks.
    - 4.4.1.10 Cooling Towers.
    - 4.4.1.11 Deaerators.
    - 4.4.1.12 Dishwashers.
    - 4.4.1.13 Dental Equipment.
    - 4.4.1.14 Garbage Disposals.
    - 4.4.1.15 Hydraulic Lifts (e.g., water powered hoists).
    - 4.4.1.16 Photo Developing Equipment (Including X-ray Film Processors).
    - 4.4.1.17 Pre-rinse Units.
    - 4.4.1.18 Solar Heating systems.
    - 4.4.1.19 Gray Water Systems.
    - 4.4.1.20 Heat Exchangers
      - 4.4.1.20.1 Single Wall.
      - 4.4.1.20.2 Double Wall.
    - 4.4.1.21 Portable Equipment.
    - 4.4.1.22 Sump/Lift Stations.
    - 4.4.1.23 Trap Primers.
    - 4.4.1.24 Water Filters.
    - 4.4.1.25 Water Treatment Systems including –
      - 4.4.26.1 Ion Exchange.
      - 4.4.26.2 Reverse Osmosis .
- 4.5 Problems associated with Multi-Story Structures.
- 4.6 Multiple Service Connections to the same Parcel.
- 4.7 Cross-connection (Shutdown) Test.
- 4.8 Types of Facilities presenting special problems:
  - 4.8.1 Auxiliary Water Sources (e.g., wells, developed lakes, creeks, springs)
  - 4.8.2 Laundry and Dry Cleaning Facilities.
  - 4.8.3 Food Retailers (e.g., Restaurants, Grocery Stores).



- 4.8.4 Food Processing Facilities.
- 4.8.5 Personal Care Salons (e.g., Beauty Salons, Spas, Barber Shops).
- 4.8.6 Schools.
- 4.8.7 Car Washes/Auto Repair Facilities.
- 4.8.8 Manufacturing/Industrial Facilities (Including “Light Industrial”).
- 4.8.9 Refineries.
- 4.8.10 Office Buildings.
- 4.8.11 Retail Outlets.
- 4.8.12 Medical/Dental Facilities (e.g., Hospitals, Nursing Homes, Labs)
- 4.8.13 Pet Facilities (e.g., Veterinarians, Groomers)
- 4.8.14 Churches
- 4.8.15 Mortuaries, Embalming Facilities, Morgues.
- 4.8.16 Photo Processing (including X-Ray) Facilities.
- 4.8.17 Recreational (including Marinas, Parks, Pools) Facilities.
- 4.8.18 Multi-Resident (e.g., Hotel, Motel, Apartment), Facilities.
- 4.8.19 Irrigation (e.g., Parks, Fields, Agricultural).
- 4.8.20 Correctional Facilities.
- 4.8.21 Bottled Water Plants.
- 4.8.22 Recycled (Reclaimed) Water.
  - 4.8.22.1 Irrigation.
  - 4.8.22.2 Dual Plumbed.
- 4.8.23 Sewage Treatment/Wastewater Handling Facilities.

**5. Methods and Assemblies to Prevent Backflow –**

The Cross-connection Control Program Specialist is expected to have a comprehensive understanding of the following:

**5.1 The following are Unapproved Methods of Protecting Cross-connections:**

- 5.1.1 Swing Connections.
- 5.1.2 Spools.
- 5.1.3 Three/Four Way Connections.
- 5.1.4 Single Check Valve.
- 5.1.5 Dual Checks (Vented and Not Vented).
- 5.1.6 Other Unapproved Assemblies/Devices.

**5.2 The Various Approved Methods for Preventing Backflow including the Design, Operation, Major Components, and Installation Requirements of each Method (as appropriate)**

- 5.2.1 Air Gap.
- 5.2.2 Barometric Loop.
- 5.2.3 Antisiphon Device.
  - 5.2.3.1 Atmospheric Vacuum Breaker (AVB).
  - 5.2.3.2 Pressure Vacuum Breaker (PVB).
  - 5.2.3.3 Spill Resistant Vacuum Breaker (SVB).
- 5.2.4 Double Check Valve Assembly (DC).
- 5.2.5 Reduced Pressure Principle Assembly (RP).
- 5.2.6 Detector Assemblies –
  - 5.2.6.1 Double Check Detector Assembly (DCDA).
  - 5.2.6.2 Reduced Pressure Detector Assembly (RPDA).

- 5.3 Proper application for each of the Methods/Assemblies used to Prevent Backflow -
  - 5.3.1 Types of Methods/Assemblies used to protect against a Health Hazard (contaminant).
  - 5.3.2 Types of Methods/Assemblies used to protect against a Non-health Hazard (pollutant).
  - 5.3.3 Types of Methods/Assemblies used to protect against Backsiphonage.
  - 5.3.4 Types of Methods/Assemblies used to protect against Backpressure.
- 5.4 Backflow Assemblies –
  - 5.4.1 Standard Pipe Sizes.
  - 5.4.2 Lists of Approved Assemblies
    - 5.4.2.1 USC FCCC & HR.
    - 5.4.2.2 California Department of Health Services Approved List.
    - 5.4.2.3 Nevada Division of Health Protective Services Approved List.
  - 5.4.3 Required Identification information found on Assemblies..
  - 5.4.4 Approved Installation Methods for each type of Assembly.
- 5.5 Field Testing and Troubleshooting of Backflow Prevention Assemblies –
  - 5.5.1 Field Testing Equipment -
    - 5.5.1.1 Recognized List of Gauges.
    - 5.5.1.2 Precautions and possible Hazards relating to the Field Testing of Backflow Prevention Assemblies.
    - 5.5.1.3 Necessary equipment to conduct a proper Field Test.
  - 5.5.2 Field Test Records
    - 5.5.2.1 Device Identification.
    - 5.5.2.2 Field Test Results
      - 5.5.2.2.1 Check Valves.
      - 5.5.2.2.2 Differential Pressure Relief Valve.
      - 5.5.2.2.3 Air Inlet Valve.
      - 5.5.2.2.4 Repair/Maintenance Performed.
      - 5.5.2.2.5 Tester Identification: a) Signature. b) Certification Number. c) Date of Initial Test/Repair/Final Test.
      - 5.5.2.2.6 Tester Comments.
      - 5.5.2.2.7 Distribution of Test Reports.
      - 5.5.2.2.8 Retention of Test Reports.
  - 5.5.3 Safety Precautions
    - 5.5.3.1 Confined Space.
    - 5.5.3.2 Removal of Access Ports or Covers under Spring Load.
    - 5.5.3.3 Tool Usage.
    - 5.5.3.4 Environmental Concerns (e.g., Organisms, Terrain, etc.)
- 6. **Cross-connection (Shutdown) Test –**

The Cross-connection Control Program Specialist is expected to have a comprehensive understanding of the Following:

  - 6.1 The Purpose and Use of the Shutdown Test.
  - 6.2 When a Shutdown Test should be Performed.
  - 6.3 Participants in a Shutdown Test.
  - 6.4 Making the Arrangements to Perform the Shutdown Test.

- 6.5 Pre-inspection of the Site prior to Conducting the Shutdown Test.
- 6.6 Physical Field Test Methods
  - 6.6.1 Dye Test.
  - 6.6.2 Pressure Test.
- 6.7 Actions to Take if a Shutdown Test indicates a Probable Cross-connection exists.

**7. Emergency response and assessment –**

The Cross-connection Control Program Specialist is expected to have a comprehensive understanding of the following:

- 7.1 Appropriate responses to an Emergency.
- 7.2 Documentation of a Declared Emergency.
- 7.3 Notification of appropriate persons and agencies when a Backflow Incident has occurred.
- 7.4 Proper documentation of a Backflow Incident.
- 7.5 Proper mitigation of a Backflow Incident.
- 7.6 Evaluation of the cause so as to prevent future similar Incidents.

**8. Public Relations –**

The Cross-connection Control Program Specialist shall understand the following:

- 8.1 The value of Cross-connection Control and how to convey that value to the public.
- 8.2 The Rules of the Employing/Contracting Agency regarding communications with the public (e.g., Some organizations have specific individuals who are the only persons authorized to communicate with the media).