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CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION PROGRAM IMPLEMENTATION AT NAVY SHORE FACTILITIES

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EXECUTIVE SUMMARY

The goal of a cross-connection control and backflow prevention program is to ensure safe drinking water under all foreseeable circumstances. A cross-connection control and backflow prevention program should establish policy, procedures, and instructions for installing, certifying, and maintaining backflow preventers to prevent contamination of drinking water systems. The purpose of this User's Guide is to provide the information necessary for activities to use in the preparation and implementation of their cross-connection control and backflow prevention programs.

The "CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION PROGRAM IMPLEMENTATION AT NAVY SHORE FACILITIES" guidance document was developed by Mr. David McMinn at Southern Division Naval Facilities Engineering Command. This document was reviewed by Mr. Abe Nachabe at the Naval Facilities Engineering Service Center. Requests for copies of this document and the Cross-Connection Control Database Management System (CCCDBMS) should be forwarded to Mr. Nachabe at DSN 551-3499, (805) 982-3499, Internet: anachab@nfesc.navy.mil.

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I. INTRODUCTION

A. Policy for Controlling Cross-Connections

The Safe Drinking Water Act (SDWA) requires that each Federal Activity with jurisdiction over a public water system comply with applicable Federal, State, and/or local requirements, whether substantive or administrative. The SDWA requirements specified in the National Primary and Secondary Drinking Water Regulations (40 CFR 141 and 143, respectively) are designed to ensure that each and every user of a public water system is provided with water which is safe to consume. One technique to help ensure compliance with these standards is to develop and implement a cross-connection control and backflow prevention program.

The Office of the Chief of Naval Operations Instruction (OPNAVINST) 5090.1B of 1 November 1994 requires that Navy drinking water supplies be constructed, operated, and maintained to comply with SDWA standards. Overseas activities should comply with the Final Governing Standards (FGSs). In this document, the term "supplies" is referred to as "systems". Section 8-5.4 of OPNAVINST 5090.1B entitled “Cross-Connection and Backflow Prevention” states that every shore installation that owns and operates a drinking water system shall ensure that a Cross-Connection Control and Backflow Prevention Program (in this document referred to as "cross-connection control and backflow prevention program" or just "program") is developed and implemented. This policy expresses a clear determination that drinking water systems are to be operated free of unprotected cross-connections that could endanger the health and welfare of users.

Section 18-5.12 of OPNAVINST 5090.1B specifies that overseas activities shall manage their drinking water per FGSs. Some overseas activities may not have been issued FGSs pertaining to safe drinking water or cross-connection control and backflow prevention. Even though in these instances there would be no regulatory requirement to implement a cross-connection control and backflow prevention program, the primary concern is to ensure that safe drinking water is provided to all users regardless of location. Therefore, overseas activities shall also develop and implement a cross-connection control and backflow prevention program following requirements outlined in this User’s Guide.

Guidelines for cross-connection control and backflow prevention contained in this document pertain to all facilities served by drinking water systems. Implementation of these guidelines is essential for the protection of the drinking water system against the entrance of contamination which may render the water unsafe or undesirable. These guidelines should be incorporated into appropriate activity and/or installation instructions that are enforced rigidly.

B. Goal

The goal of a cross-connection control and backflow prevention program is to ensure safe drinking water under all foreseeable circumstances. Each instance where potable water piping is improperly configured and can create the possibility of backflow threatens the health and safety of users and reduces the chances of realizing the cross-connection control and backflow prevention program goal. The possibility of backflow due to improper piping/configuration layout within facilities is especially significant because such cross-connections may easily result in the contamination of the drinking water system. These situations may result in the drinking water system becoming a transmitter of pathogenic organisms, toxic materials, or other hazardous substances which can adversely affect public health and welfare. The only protection against such occurrences is the elimination of cross-connections or the protection of the drinking water system by proper application of backflow prevention procedures.

Cross-connections, interconnections, auxiliary intakes, or bypasses should be eliminated or backflow prevention should be installed. If the deficiency cannot be eliminated for whatever reason, an approved backflow preventer (BFP) must be installed, based on the potential or actual hazard, between the fixtures, equipment, appliances, or facilities, and the potable water supply. BFPs must be installed when backpressure and/or backsiphonage from fixtures, equipment, appliances, or facilities could contaminate or pollute the drinking water system. The intent of the approved BFP is to protect the potable water supply and to protect the health of water consumers.

C. Purpose of this User's Guide

A cross-connection control and backflow prevention program should establish policy, procedures, and instructions for installing, certifying (via inspection and testing), and maintaining BFPs to prevent contamination of drinking water due to backpressure backflow or backsiphonage backflow of contaminants. The purpose of this User's Guide is to provide the information necessary for activities to use in the preparation and implementation of their cross-connection control and backflow prevention programs. State regulatory agencies will typically require that a document be prepared which provides the Activity or water system's procedures for implementing cross-connection control and backflow prevention. Appendix C provides a cross-connection control and backflow prevention program template for use by Navy activities.

It is not the intent of this User's Guide to provide "cookbook" information which can be obtained from the typical reference manuals shown in Section I.D. Personnel assigned to coordinate cross-connection control and backflow prevention programs should realize that many cross-connection control and backflow prevention issues are subjective in nature. Cross-connection control

and backflow prevention personnel should consult reference manuals and regulatory authorities for answers to most specific questions.

Words such as "shall/will" and "must" are used in this User's Guide to denote action items that are important in order to have a successful program. This wording is not intended to limit the freedom of individual activities to modify requirements, as necessary, to comply with State and/or local requirements.

Attempts have been made to provide requirements/information which, if implemented by all activities, will yield consistency between Activity programs while at the same time rendering compliance with applicable State and local requirements, however stringent they may be.

D. Other Reference Documents

Reference documents, other than those in Section I.A. above, that can be used when implementing a cross-connection control and backflow prevention program are:

"Manual of Cross-Connection Control", Foundation for Cross-Connection Control and Hydraulic Research (FCCCHR), University of Southern California, Los Angeles, CA 90089-0231 (latest edition).

"Recommended Practice for Backflow Prevention and Cross-Connection Control", Manual M14, American Water Works Association (AWWA) (latest edition).

Applicable standards issued by the American Society of Sanitary Engineering (ASSE) for individual devices and assemblies.

E. Definitions and Acronyms

Definitions and terms applicable for the interpretation and administration of this User's Guide are provided in Appendix A. Acronyms used in this document and their meanings are provided in Appendix B.

II. PROGRAM TO BE PURSUED

In general, a cross-connection control and backflow prevention program is a continuing effort to locate and correct all existing or potential cross-connection hazards and to discourage their creation. Specific requirements for cross-connection control and backflow prevention and its implementation seem to be highly subjective and somewhat variable. Although this User's Guide is designed to afford full protection, attempts were made not to overprotect so as to eliminate wasteful spending and prevent needless pressure reductions due to excessive numbers of BFPs.

To better understand the reasoning used when developing this User's Guide, it is necessary to contrast Government jurisdiction over its drinking water systems against the private sector's relationship to its drinking water systems. In the private sector, the water purveyor normally has no control over the internal plumbing within a facility. The water purveyor can therefore require that a BFP be provided on the external service line to satisfy the highest degree of hazard within the facility in order to adequately protect the purveyor's main drinking water distribution system. The Government activity normally has jurisdiction over the entire distribution system (within the confines of Government property), the water service laterals, and the internal plumbing system and operations within facilities. As such, the Government will oversee the execution of the cross-connection control and backflow prevention program for both internal plumbing and the external main drinking water distribution system. This gives the Government greater flexibility in protecting its system than the private sector, and this should enter into the decision making process when developing installation specific criteria and policy.

A. Cross-Connection Surveys

A survey of all facilities served by the drinking water system will be performed. The purpose of the survey is to determine possible or actual cross-connections, degree of hazard, location and adequacy of existing BFPs, and the need for installation of additional BFPs. It is recommended that those facilities having operations which could result in the most hazardous cross-connections be investigated first. Investigations shall continue until all facilities to which drinking water is supplied have been surveyed. Surveys will involve each facility's entire internal water plumbing system including the various outlets, water-using equipment, etc. Results of these surveys must be recorded and must be used to initiate records for installing BFPs and for scheduling tests. Requirements for new or additional BFPs must be documented and placed within the documented program.

Surveys of facilities should be performed by certified testers (see Section II.I. for discussion of certification procedures for testers). Certified testers are best qualified to perform surveys since they will enter the majority of water-using facilities on a periodic basis to certify BFPs and will also be knowledgeable of backflow principles. In addition, it is highly recommended that certified testers

have knowledge and experience with mechanical and water distribution/plumbing systems. This will enable them to properly identify sources of actual or potential backflow contamination, evaluate the correct BFPs to be used, and properly locate the BFPs in the distribution/plumbing system.

During the initial survey, all existing BFPs must be identified, certified for proper installation and operation, and placed into an inventory database. BFP certification procedures and frequencies are discussed in Section II.C. and the inventory database is discussed in Section II.H. If an existing BFP is not or cannot be certified, or does not provide adequate protection for the degree of hazard involved, it must be replaced as soon as possible with an approved BFP and certified for proper operation. Depending upon the degree of hazard, securing the water services in the interim may be required as discussed in Sections II.F. and II.L.

When performing recertifications within facilities, the tester has the opportunity to inspect processes and plumbing to determine if new cross-connections have been created and if any corrective action is necessary. Reinspection of the facility will automatically be an integral part of the certification visit and will be performed at least once per year. If this technique is employed, there should never be a need to perform another "Activitywide" survey.

To the maximum extent possible, personnel who certify BFPs will be separate from the individuals responsible for installing and maintaining BFPs. This helps to prevent a possible "conflict of interest" issue and offers a system of "checks and balances" to ensure that BFPs are installed, maintained, and certified properly.

B. Installation of BFPs

Where cross-connections exist, the problem will be eliminated or isolated by creating an air gap, or properly installing an approved BFP to prevent the possibility of backflow into the drinking water system. Section III. of this document provides additional information regarding approved BFPs, locations for installation, etc. The installation must comply with criteria set forth by Federal, State, and local codes/regulations, the manufacturer's recommendations, and reference documents addressed in Section I.A. and I.D.

C. Certification of BFPs

The certification of BFPs will be accomplished by certified testers. A new BFP should be accepted only after receiving official certification that it fully satisfies approved installation and performance standards. Ideally, water should not be used through a newly installed or repaired BFP until the BFP has received official certification. Realistically, a certified tester may not be immediately available and restoring the water supply may be necessary. It is acknowledged that

individuals installing and/or maintaining BFPs normally perform immediate testing to determine that the BFP is operating properly. Although this testing by the individual performing installation/maintenance should not be considered official certification for reasons stated in Section II.A., it can suffice for restoring water to the user pending official certification. Official certification must be rendered as soon as possible. To ensure that all BFPs continue to function properly, recertification should be performed according to the schedule specified below.

All certification tests shall be made using certified test equipment and test procedures conforming to those outlined in the latest edition of the "Cross-Connection Control Manual" published by the FCCCHR or Manual M14 published by the AWWA. Testable BFPs include the reduced pressure backflow preventer (also known as reduced pressure principle (RPP) or reduced pressure zone backflow preventer (RPZ)), the reduced pressure principle-detector assembly (RPDA), the double check valve assembly (DCVA), the double check-detector check assembly (DCDA), and the pressure vacuum breaker (PVB). Only tests performed by certified testers of the Activity having jurisdiction, or other certified testers engaged by the water purveyor, should be considered official tests. [NOTE: Since information on test equipment and procedures for certifying BFPs is available in the above referenced manuals, procedural details are not given in this User's Guide.]

The certification schedule must be placed in the recurring work program. BFPs shall be routinely certified based on the following maximum certification intervals but may be certified more frequently if desired:

Class of Hazard	**Maximum Certification Interval***
Low	12 Months
High	6 Months

* NOTE: To facilitate certification scheduling, it may be beneficial for an Activity with a relatively large number of BFPs to schedule recertifications of a particular BFP for the same timeframe(s) each year. It is permissible to perform recertification testing for a certifiable high hazard BFP anytime during the sixth calendar month following the calendar month for the previous certification. For a certifiable low hazard BFP, recertification could be scheduled anytime during the twelfth calendar month following the calendar month for the previous certification. This means that a high hazard BFP certified on April 1 may undergo recertification testing anytime during October of the same year, although the actual recertification interval would fall between 6 and 7 months. Likewise, the recertification interval for a low hazard BFP could fall between 12 and 13 months. If the high hazard BFP fails the recertification test in October and is repaired but is not certified until November, the Activity has the option to

perform the next recertification in April based on the original schedule or slip it to May based on the new schedule.

Non-testable BFPs such as hose bibb vacuum breakers (HBVBs), residential dual check valves (DCs), and air gaps (AGs) cannot be certified for proper operation because there are no test cocks. In-place inspection of these devices only serves to verify that they have not been removed or altered and does not indicate condition. Atmospheric vacuum breakers (AVBs) also have no test cocks; therefore, there is no approved method for testing. It can be determined whether the AVB is working by turning off the water at the shutoff valve upstream of the AVB. The check valve can usually be heard as it falls. A visual inspection can also be made by removing the canopy of the AVB. An AG can be visually inspected to ensure that the proper gap measurements are being maintained and that no temporary or permanent physical connection has been made.

During the certification visits, it is suggested that the certified tester investigate to ensure that: (1) additional cross-connections, actual or potential, have not been created, in the vicinity of the BFP, and (2) backflow protection has not been bypassed or altered. Depending upon the size of the facility and the availability of time, it is considered feasible to conduct a survey of the facility in conjunction with certification visits to ensure that no new unprotected cross-connections have been created. This is further discussed in Section II.A. above.

D. Maintenance/Replacement of BFPs

Maintenance of BFPs shall be performed by experienced personnel. BFPs will be maintained in a good state of repair. Should a BFP be found defective, it will be repaired promptly or replaced to provide proper backflow protection. Following repair/replacement, it is to be certified as satisfying acceptable performance standards. Overhaul intervals shall be set according to the age and condition of the BFP and recommendations by the manufacturer, but should not exceed 5 years. It is recommended that DCs be automatically replaced on a scheduled basis not to exceed 5 years to help ensure continued protection.

E. Funding for Construction/Repair of BFPs

Each Activity has the responsibility to ensure that the appropriate funding type (Operation and Maintenance Navy - O&MN versus Military Construction - MCON) is used when performing corrective actions. Funding guidelines and clarification may be obtained from the applicable Major Claimant, Comptroller, etc.

If corrections can be O&MN funded and the entire amount of funds is not available in one fiscal year, it is possible to phase the work effort within anticipated available dollars using various techniques. One technique is to phase corrections based on degree of hazard, with the high hazards being protected first and the low hazards second. Another technique would be to accomplish isolation protection first and containment protection second. Although more difficult to evaluate for purposes of phasing, risk factors could be assigned for specific water uses and the potential for backflow to occur for each specific water use.

F. Enforcement Actions for Failure to Correct Cross-Connection Deficiencies

Where cross-connections, interconnections, auxiliary intakes, or bypasses are found to constitute a high hazard of contaminating the drinking water system, immediate corrective action shall be taken to eliminate the deficiency. Failure to correct conditions threatening the safety of the drinking water system shall be grounds for denial of water service. Reasons for denial of water service may include, but not be limited to, the following: proper protection cannot be provided within a reasonable timeframe; there is failure to maintain the BFP in proper working order; there is removal, bypassing, or altering of a BFP so as to render it ineffective, etc.

It is impractical in most instances to immediately discontinue water service to a facility unless an actual backflow emergency causing illness or death exists or has occurred in the past. Therefore, consideration should be given prior to discontinuing water service solely because of a lack of BFPs or lack of maintenance of BFPs. If illness or death can be attributed to past backflow occurrences, water service shall be immediately discontinued and physically separated from the water system in such a manner that no unauthorized persons can reconnect water service. If a history of illness or death cannot be linked to backflow of contaminated water from the facility, water service shall be discontinued only after the facility owner or responsible custodian is given a mutually agreed upon timeframe to correct the deficiency. Regarding discontinuance of water service to a facility, consideration should be given as to whether the resulting loss of pressure could cause contamination of the facility's plumbing system and whether fire protection capabilities will be compromised.

A letter should be issued to the occupant/building manager (custodian) and/or owner of the facility stating the nature of the hazardous condition that threatens

the safety of the water system. The recipient of the letter shall be advised that it is necessary to take certain steps to minimize the danger of contamination and that failure to take such action could result in illness or death. If water service is secured to a facility, it shall not be restored until the deficiencies have been corrected or eliminated.

Where the use of water is critical to the continuance of normal operations or protection of life, property, or equipment, a duplicate parallel BFP shall be provided to avoid the necessity of discontinuing water service to test or repair a single BFP. Where it is found that only one BFP has been installed and continuance of service may be critical, the occupant of the facility shall be notified, in writing, of plans to discontinue water service and arrangements shall be made for a mutually acceptable time to test and/or repair the BFP.

G. Reports

During the field surveys, field visit sheets will be completed showing details of significant findings. The findings will be reported in writing along with recommendations for corrective action necessary to properly protect the drinking water system. Whenever possible, the hazards that cross-connections pose should be explained fully to users and/or the responsible authority within facilities. These individuals should be informed that information gathered during the survey will be reviewed and that a written report containing any recommendations will be prepared.

H. Recordkeeping

Good records are invaluable in efforts to safeguard the quality of water being distributed against degradation from backflow through cross-connections. Adequate records will be maintained to:

- Document the overall effort to ensure that each user receives safe water under all foreseeable circumstances.

- Give a complete picture as to the current status and history of individual facilities regarding the potential for backflow, corrections made, etc.

- Support enforcement action, whenever necessary, to obtain backflow protection.

- Document that BFPs have been properly installed, certified, and maintained.

A Cross-Connection Control Database Management System (CCCDBMS) developed by the Department of the Navy can be obtained for maintaining all records regarding BFPs and test kits. Information regarding personnel assigned to

implement this program can also be entered into the CCCDBMS. Although activities have the option to use other recordkeeping procedures, it is strongly recommended that the CCCDBMS be utilized. This would provide Navy-wide consistency for scheduling inspections, generating applicable field inspection forms for various types of BFPs, and tracking all information associated with inventory, certification, maintenance, etc., of all BFPs. The CCCDBMS also provides consistency within the Navy for forwarding individual Activity information regarding implementation of the cross-connection control and backflow prevention program to higher echelons upon request. Certification forms to be completed in the field will be similar to "industry standards" provided in the reference documents in Section I.D. Completed field inspection forms signed by the certifying cross-connection control and backflow prevention representative will be retained and all information should be immediately input into a computerized database.

The CCCDBMS yields information in a format that should be accepted by regulatory authorities. Separate "massaging" of the information may be necessary to satisfy local requirements.

Computerization of all data should be assigned to representatives who coordinate overall implementation and/or certify BFPs because these individuals will be more routinely involved in day-to-day program implementation than individuals performing installation and/or maintenance.

I. Training/Education for Personnel Administering the Cross-Connection Control and Backflow Prevention Program

Personnel responsible for successful implementation of the cross-connection control and backflow prevention program are much more likely to take their responsibilities for preventing backflow more seriously if they understand the reasons for implementing the program and if they are made aware of the important role they play in the implementation process. Ideally, all personnel associated with implementation will receive training in the various cross-connection control and backflow prevention topics mentioned below. Applicable personnel include the program director, program manager, program coordinator, inspectors, testers, maintenance personnel, water plant operators and distribution personnel, and Resident Officer In Charge of Construction (ROICC) personnel. In addition, if Base Operating Services (BOS) contractor personnel are used for implementation of any portion of the program, these individuals must also be properly trained/certified.

Although each Activity will decide who receives training and the amount of training required, it is imperative that personnel responsible for inspecting facilities for cross-connections, certifying BFPs for proper installation and operation, and making recommendations for corrective action be properly certified as discussed below. If certified testers are separate individuals from

those performing installation and/or maintenance, it is not mandatory that installation and/or maintenance personnel be certified since certified testers will certify proper operation following installation or maintenance. If testing and installation/maintenance are performed by the same personnel, then certification is required for these personnel as discussed above. As addressed previously in Section II.A., certified testers should have knowledge and experience with mechanical and water distribution/plumbing systems in order to properly identify sources of actual or potential backflow contamination, evaluate the correct BFPs to be used, and properly locate the BFPs in the distribution/plumbing system.

Certification is normally available through a course sponsored by the State or local regulatory agency followed by successful completion of a test at the conclusion of the course. Certification courses may also be provided by colleges/universities in your applicable State. Other sources that should be acceptable to any regulatory agency would be the certification course offered by the Training, Research and Education for Environmental Occupations (TREEO) Center - University of Florida Division of Continuing Education, the FCCCHR - University of Southern California, or the American Backflow Prevention Association (ABPA). Certifications are usually good for a period of 2 years (may vary depending on the State or local regulatory agency) and may be renewed by attending a follow-up refresher course or by writing a letter to the State requesting extension of certification.

Currently, there are no known requirements for certification of maintenance personnel although there are courses available for instruction of maintenance procedures. Information regarding maintenance courses should be available from State or local regulatory agencies, or institutions such as the Center for Training, Research and Education for Environmental Occupations (TREEO Center) - University of Florida Division of Continuing Education or the FCCCHR - University of Southern California.

J. Public Awareness Efforts

Measures should be taken to acquaint consumers with the program being pursued to safeguard the quality of water being distributed, and to inform them of the importance of cross-connection control and backflow prevention, their role in cross-connection control, and health hazards associated with cross-connections.

The following measures are suggested for providing education regarding cross-connection control and backflow prevention:

- Display posters at the Water Treatment Plant.

- Annually (or more often) furnish the local Base newspaper with an article discussing the importance of cross-connection control and backflow

prevention and an illustration of a cross-connection contamination or pollution incident.

- Distribute flyers and/or posters explaining the importance of cross-connection control and backflow prevention to users working in high hazard or industrial facilities.

- Conduct on-Base seminars about the cross-connection control and backflow prevention program for water users.

- To the maximum extent practicable, discuss the importance of cross-connection control and backflow prevention with users when conducting facility surveys and certification of BFPs. Appendix D provides an example of water consumer training information.

K. Review of Plans and Specifications for Projects

One effective technique for controlling cross-connections is to incorporate BFPs into new construction, repair, or modification projects during the design phase. To accomplish this, personnel trained in cross-connection control and backflow prevention shall provide technical review of all plans and specifications associated with the construction of new facilities and/or the repair/modification of existing facilities to ensure that approved BFPs are incorporated during the design phase. This will require close coordination between the utility system design engineer, ROICC, cross-connection control personnel, and other individuals assigned to review and provide comments on plans and specifications.

L. Backflow Contingency Plan

Because backflows may occur even with a comprehensive cross-connection control and backflow prevention program in place, a contingency plan shall be developed to deal with backflow emergencies. The contingency plan will address the following: information that should be gathered when receiving notification of an actual or potential problem, how to investigate the actual or potential problem, how to determine if a backflow has occurred, and how to respond to the notification or backflow emergency (including immediate, short-range, medium-range, and long-range responses). The following breakdown is not necessarily all inclusive but provides more detail regarding types of information to be included in a contingency plan regarding backflow:

1. Gather relevant information.

- Name, address, and phone number of person(s) making notification.
- Description of problem.
- When was the problem first noticed and how often or particular time the problem occurs.
- Any ideas as to the cause of the problem.
- Is person making notification a year-round resident?
- Did anyone become ill? If yes, the following questions should be answered: How many people became ill? What were their symptoms? Did they go to hospital/clinic? What is doctor's name?

2. Lines of communication.

Lines of communication (points of contact) shall be identified including names and phone numbers of designated personnel in case of an emergency (e.g., Public Works Officer, program coordinator, Preventive Medicine, Hospital, Security/Police Department, Fire Department, Environmental Department, etc.). If required by the applicable State or local regulatory agency, the regulatory agency will be notified by the program coordinator or his/her designee within 24 hours of verification of backflow contamination.

3. Staged responses.

a. Immediate responses.

Immediate responses should be performed as soon as possible, but in no case more than 24 hours after receiving notification of an actual or potential problem. The following actions should be taken to minimize actual or potential detrimental effects if backflow contamination occurs or is suspected of occurring:

- Collect water samples at the site of the actual or suspected problem and analyze for the following parameters: pH, chlorine residual, bacteriological analysis, and other parameters to be determined by the Activity public works, environmental, and medical personnel.

- De-activate all drinking water coolers and faucets from which drinking water may be obtained in the area of concern.

- Minimize the "spread" of contaminated water through containment within the facility's plumbing system, if possible, by shutting off appropriate water valves.

- Notify appropriate parties via the chain of command as deemed necessary, based on actual or suspected hazard.

- Provide notification to water users within the area of concern through the most expedient means available.

Water distribution maps as well as records kept as part of the cross-connection control and backflow prevention program will be utilized as additional information to assist in accomplishing the above actions.

Receipt of laboratory analyses for samples collected above could take from one to several days. Upon receipt, the existence and extent of backflow contamination must be determined. If backflow contamination is confirmed, the following medium-range actions should be taken.

b. Medium-range responses.

Medium-range responses include steps to restore the quality of the water distributed via the facility's internal plumbing and must be accomplished prior to reactivating the plumbing system. During this timeframe, bottled water will be supplied for drinking purposes. Depending upon the degree of hazard, medium-range responses may include the following actions:

- Determine the cause of the problem by searching for cross-connections not protected by a BFP or by inspecting and testing applicable BFPs.

- Eliminate the cross-connection by creating an approved AG or installation and certification of an approved BFP.

- Repair/replace and certify existing BFPs, as necessary.

- Flush and disinfect water lines followed by testing to ensure the contaminant has been completely removed prior to placing water lines back into service.

- Replace water lines, if necessary.

c. Long-range responses.

Long-range responses will include a review of how the emergency was handled in order to improve future responses to contamination of the water supply. The performance of all individuals who were

involved in the backflow incident will be reviewed. Re-education and improving lines of communication may be necessary.

III. PROTECTIVE MEASURES REQUIRED

A. Basic Considerations

In providing protection against cross-connections, there are two separate and distinct areas of concern that closely relate to one another. They are:

- Isolation protection to protect the health and welfare of the occupants or users of the drinking water system within the facility against contamination emanating within the facility. This is accomplished by installing an approved BFP on the water line directly serving the actual or potential cross-connection.

- Containment protection to protect the health and welfare of the community at large by protecting the main water distribution system against contamination emanating within a facility. This is accomplished to varying degrees (depending on the situation) by providing internal protection, installing an approved BFP on the service line to a facility, or by a combination of both techniques.

In determining whether isolation protection can be relied upon to protect the drinking water system, a number of factors must be evaluated in making a decision. Some factors to consider include:

- The degree of hazard involved.
- The likelihood of frequent and/or unapproved plumbing changes.
- The probability of frequent modification of water-using equipment.
- The complexity of the internal piping system.
- The difficulty in making inspections to verify that isolation protection provided is being adequately maintained.
- The likelihood of BFPs being rendered ineffective.
- The ease of access to the facility.

Recommended procedures for implementing isolation and containment protection are discussed in Sections III.B. and III.C.

B. Isolation Protection

Isolation protection provides protection to persons consuming water within a facility by "isolating" the particular contaminating source with an appropriately rated BFP. To determine the various locations where isolation protection will be necessary, each facility's entire internal plumbing system and the various drinking

water uses will be investigated. [NOTE: Responsibility for administration of the program for the internal plumbing system of facilities owned and/or occupied by reimbursable customers is subject to negotiated decisions specified in intra-service support agreements (ISSAs) or utility service contracts.] If properly implemented, isolation protection not only safeguards the quality of water within the facility but also affords protection for the drinking water system external to the facility.

C. Containment Protection

Containment protection prevents any contamination emanating within a facility from entering the drinking water system external to the facility by placing an approved BFP on the service line upstream of any branches serving individual sources within the facility. If successful implementation of isolation protection cannot be ensured, then appropriate containment protection must be implemented based on the highest degree of hazard existing within the facility.

As addressed in Section III.G.2., it is recommended that containment protection be provided for certain high hazard facilities regardless of the isolation protection provided.

D. Degrees of Hazard

In general, there are two degrees of hazard associated with cross-connections. These are defined as follows:

1. **Low (Non-Health) Hazard**: If a backflow was to occur, the resulting health significance would be limited to changes in the aesthetic quality, such as taste, odor, or color. The foreign substance must be non-toxic and non-bacterial in nature, with no significant health effect.

2. **High (Health) Hazard**: If a backflow was to occur, the resulting effect on the water supply could cause illness or death if consumed by humans. The foreign substance may be toxic to humans either from a chemical, bacteriological, or radiological standpoint. Detrimental health effects of these contaminants may result from short or long term exposure.

E. Types of Approved BFPs Based on Degree of Hazard

The types of BFPs which may be used for each degree of hazard are provided below. Refer to Appendix A for the definition of the acronyms.

Degree of Hazard	Approved BFP Types
Low	AG, RPZ, RPDA, DCVA, DCDA, AVB, PVB, HBVB, DC
High	AG, AVB, RPZ, RPDA, PVB

An approved AG may be used under any and all hazard and pressure conditions.

An RPZ protects against both backpressure and backsiphonage and can be used for any degree of hazard.

An RPDA operates similarly to an RPZ except that the bypass meter arrangement allows for detection of leakage or unauthorized water use. The degree of protection against backflow is identical to that provided by the RPZ.

A DCVA works in a backpressure or backsiphonage mode. This BFP does not discharge water, and does not provide a visual sign of backflow or unit malfunction. Therefore, it does not offer the degree of protection provided by the RPZ.

A DCDA operates similarly to a DCVA except that the bypass meter arrangement allows for detection of leakage or unauthorized water use. The degree of protection against backflow is identical to that provided by the DCVA.

PVBs and AVBs are primarily in-plant or end-of-service (point of use) line solutions to a cross-connection. They are placed at the end of a line, and on fixtures or equipment that discharge to atmospheric pressure. These do not protect against backpressure, only against backsiphonage. PVBs can be used under continuous supply pressures for any degree of hazard so long as it is subject only to backsiphonage and not to backpressure. AVBs can be used on low and high hazard situations where they will not be subject to continuous pressure or backpressure. There must be no valve downstream from an AVB. It is recommended that AVBs are installed 6 inches above all downstream piping and outlets. It is also recommended that PVBs are installed 12 inches above all downstream piping and outlets.

HBVBs are to be placed on all outside hose bibbs and any internal hose bibbs where it is possible that a hose could be attached to the faucet and extend into contaminated water/liquid. These are considered low hazard devices but provide

an extra means of protection against any contamination which could backsiphon through a hose. Either threaded or "built-in" HBVBs are suitable for use.

DCs are included in this document as an alternative to DCVAs and should only be used upon approval of the State or local (municipal) regulatory authorities. They are low hazard devices. They can be used for residential service lines where low hazard protection would be beneficial at lower cost and would be more aesthetically pleasing than using a DCVA.

F. Approving Authority for BFPs

States, local agencies, and water districts specify the requirements for BFPs. There are several agencies that approve BFPs. FCCCHR has the most stringent requirement. It is recommended that activities utilize BFPs that are approved by FCCCHR whenever feasible. The Activity should ensure that the BFPs installed are acceptable to the State and/or local regulatory authorities.

All BFPs will be properly installed in approved locations in conformance with guidelines established by the manufacturer of the BFP and the above entities.

G. Circumstances Requiring Protection Against High Hazards

1. An approved RPZ or approved AG shall be required on water lines under the following circumstances:

    a. To isolate auxiliary water sources, including:

        - Private wells.
        - Surface water sources.
        - Recirculated waters, process fluids, gases, etc.
        - Stored water, from the drinking water system, in other than acceptable facilities or that receives chemical or other treatments.
        - Reclaimed water.

    b. To protect against submerged outlets or connections to tanks or piping systems associated with the following [NOTE: A PVB may also be used as internal protection against high hazard as long as it is only subject to backsiphonage and not backpressure]:

        - Tanks or other containers containing, or possibly containing, contaminated substances (chemical, bacteriological, radiological, etc.).
        - Heating or cooling coils submerged in containers.
        - Boilers, fire protection systems, chilled water systems, etc., that utilize water containing special chemical additives.

- Commercial boilers, with or without treatment.
- Sewage treatment plants and pumping stations where backflow potential exists.
- Facilities for direct flushing of waste hoppers, sewers, etc.
- Industrial or other piping systems.
- Irrigation systems as described in Section III.J. below.
- Outlets located on piers, docks, etc., for conveying potable water for shipboard use.

2. Because of the high degree of hazard involved in the following types of facilities, it is necessary that containment protection (see NOTE below), consisting of an AG or an RPZ, be provided in addition to any isolation protection:

   - Facilities with auxiliary water supplies.
   - Facilities where inspection is restricted.
   - Hospitals, mortuaries, clinics, veterinary clinics, dog kennels, or other similar facilities.
   - Sewage treatment plants and pumping stations.
   - Chemical plants.
   - Metal plating plants.
   - Facilities where chemicals will be mixed or prepared for use such as pesticide control shops, etc. This does not include facilities housing only boilers or cooling towers when isolation protection is provided.
   - Processing plants (food, beverage, petroleum, or other) where processed or used water may be cross-connected to the drinking water system.
   - Manufacturing plants or shops with water-using equipment or other uses that can degrade water quality.
   - Facilities using and/or storing radioactive materials/wastes.
   - Dedicated hazardous materials and/or hazardous waste storage facilities.
   - Laboratories.

   (NOTE: The above listing is not all inclusive. Other facilities must be individually considered depending on the types of processes conducted within.)

3. Construction contractors obtaining their water supply by temporarily "tapping" into the Activity drinking water system at a conveniently accessible location, such as a fire hydrant, shall be required, at his/her own expense, to install and certify an approved RPZ at each tap. Certification must be performed by a certified tester independent of the contractor. The ROICC and the cross-connection control and backflow prevention coordinator should be notified by the contractor prior to certification and both should receive and review the completed certification forms prior to

issuing approval to the contractor to initiate water use. Contractors need to obtain permits from the appropriate agency each time they need to tap into the potable water system.

H. Residential Considerations

It is noted that requirements pertaining to the need for and/or type of backflow prevention to be used on residential service lines may differ depending on local/municipal ordinances. Some States/localities may require nothing while others may authorize the use of the DC or require a DCVA. It is acknowledged that the DC is not approved by the University of Southern California FCCCHR because of the lack of test cocks. Compared to the DCVA, there are some inherent advantages to this device (e.g., lower material and labor costs, more aesthetically pleasing, etc.) as well as disadvantages (e.g., cannot be tested in-line, may not be readily replaced if inoperable, etc.).

At a minimum, HBVBs should be placed on all exterior hose bibbs. For residential domestic or fire service lines, applicable State and/or local regulatory authorities will be consulted for requirements regarding acceptable protection.

I. Fire Sprinkler Systems

Approved BFPs must be an integral part of new and/or existing fire sprinkler systems as further discussed below. This applies only to fire protection systems that utilize the potable water distribution system for all or a portion of the fire protection water supply AND where the distribution system supply pressure is sufficient to overcome pressure losses through the BFPs and still activate the sprinkler systems.

The ability of the water distribution system to supply adequate pressures necessary to activate fire sprinkler systems is of major concern. Pressure losses due to BFPs on the fire service lines or sprinkler risers may complicate these problems. Recognizing that the primary purpose of fire sprinkler systems is to safeguard lives and property from fire hazards, BFPs should not be installed on sprinkler systems where resulting pressures would yield inadequate firefighting capabilities. In all cases, evaluation of available distribution system pressure/flows shall be performed and, if deficient, improvements shall be made to remedy pressure/flow deficiencies. An evaluation of this nature should already be an integral part of the design package for new construction of facilities which will increase demand on the Activity fire protection system.

It is recognized that referenced guidance may suggest that fire loops and sprinkler systems will not normally require BFPs if they satisfy the following conditions: not subject to flooding, contain no antifreeze or other chemicals, and are not supplied by separate fire protection storage or auxiliary water supply. However, two reasons are given for recommending approved BFPs for all fire sprinkler

systems. First, many fire sprinkler systems are constructed of black iron pipe. Black iron pipe (or water standing in black iron pipes) is not approved for potable use. Second, regardless of the construction material of the sprinkler system, water standing in the system over long periods of time will stagnate and be subject to contamination due to lack of disinfection.

Fire sprinkler systems are normally equipped with two single check valves. The alarm check valve is responsible for detecting flow to the sprinklers for activating the alarm system. The check valve associated with the fire department connection prevents water in the pressurized system from flowing back through the connection to the ground when the connection is not in use. Neither of these check valves are recognized as approved BFPs.

All RPZs, DCVAs, and their respective detector assemblies used for fire sprinkler systems must be equipped with open stem and yoke (OS&Y) valves. The FCCCHR approved listing includes BFP assemblies that have been tested and approved with various types of shutoff valves, including OS&Y valves.

Based on the above discussion, the following requirements and recommendations are made for those sprinkler systems receiving adequate supply pressures:

- All new fire sprinkler systems shall have approved BFPs installed on the fire service line/sprinkler riser. For new sprinkler systems that are connected to the potable water system but have no chemical firefighting additive (i.e., low hazard systems), DCVAs are sufficient. For new sprinkler systems that are connected to the potable water system and a firefighting chemical has been added (i.e., high hazard systems), RPZs are required. For new sprinkler systems connected to the potable water system that also use a nonpotable water supply (i.e., high hazard systems), RPZs are required regardless of the addition of firefighting chemicals.

- All existing high hazard systems as defined above shall be retrofitted with RPZs.

- It is recommended that existing low hazard systems as defined above be retrofitted with DCVAs; however, it is only considered a requirement if dictated by the State or local regulatory authority.

- If a group of facilities receives fire protection via a dedicated fire loop, then an approved BFP depending on the highest degree of hazard served must be installed at the interconnection of the fire loop and the potable water distribution system. This will be done in lieu of installing separate BFPs on each fire sprinkler system. This is considered a requirement whether the sprinkler systems are new or existing.

- The above requirements also apply to single family or duplex residences having fire sprinkler systems. Most of these sprinkler systems would be considered low hazard. For residential applications, DCs may be used if approved by applicable State or local (municipal) regulatory authorities.

J. Irrigation Systems

An irrigation system can be classified as either high (health) hazard or low (non-health) hazard based on the type of sprinkler head and whether chemicals are injected into the system. If the irrigation system is supplied by a source other than the drinking water system and is physically separated from the drinking water system, no BFP is required.

An RPZ or PVB may be used for high hazard irrigation systems that are directly connected to the drinking water system. High hazard irrigation systems have the following characteristics:

- Irrigation system is injected with pesticides or fertilizers for application via the irrigation system.

- Irrigation system has pop-up sprinkler heads or ground level sprinkler heads that may be contaminated with land-applied pesticides or fertilizers.

An RPZ must be used if the potential for backpressure exists. The PVB is only approved for backsiphonage conditions and cannot be subjected to backpressure. Installation specifications for the PVB require that it be installed a minimum of twelve (12) inches above the highest piping and outlet in the system downstream of the PVB. The PVB must not be subject to flooding and must be installed in the direction of flow.

An RPZ should be used if there are valves downstream that would cause continuous pressure on the device. Although a PVB can be subjected to continuous pressure, the air inlet spring may not totally mitigate the possibility of the air inlet valve becoming sealed closed. The air inlet valve will often stick in the closed position if the PVB is subjected to long periods of continuous pressure. Therefore, the PVB is not recommended for irrigation systems subject to long periods of continuous pressure.

Both the RPZ and the PVB can be used for low hazard irrigation systems. These systems include those that are not injected with chemicals and have sprinkler heads permanently elevated above the ground surface. PVB can not be subjected to backpressure. Theoretically, an AVB may also be used for low hazard irrigation systems but cannot be subjected to backpressure or have downstream valves. In addition, AVBs are limited to non-continuous use. AVBs can only be used 12 hours out of any 24-hour period.

K. Parallel Units

The installation of parallel units should be required if the user cannot readily accommodate interruptions of water service for periodic testing and repairs of the BFP or is unwilling to cooperate in scheduling a prompt shutdown for testing during normal hours worked by water system personnel.

L. Outlets Connected to Nonpotable Water Sources

Any water outlet that could be used for drinking or domestic purposes and is not supplied by the drinking water system must be labeled in a conspicuous manner such as:

WATER UNSAFE
FOR DRINKING

The minimum acceptable sign shall have white letters a minimum of 1 inch high located on a red background. Where necessary, the signs should be multi-lingual. If there is a concern that people such as young children may not read or adhere to the sign, the applicable outlets should be disconnected or locked shut so that only authorized personnel could utilize them.

M. Technical Assistance

Personnel trained in cross-connection control and backflow prevention will provide necessary technical assistance concerning the procurement and/or installation of BFPs for achieving the desired protection and to minimize maintenance and testing problems.

IV. PERSONNEL RESPONSIBILITIES

General responsibilities for various categories of persons involved with cross-connection control and backflow prevention are discussed below.

A. Commanding Officer

The Commanding Officer having jurisdiction over the Installation/Activity potable water system shall be responsible for the following:

- Assume overall responsibility for execution of the cross-connection control and backflow prevention program.

- Ensure that sufficient personnel are assigned and properly trained/certified to implement the program using the guidelines specified herein.

- Ensure that good lines of communication exist between the various personnel assigned to implement the program.

- Establish and enforce an effective procedure for having appropriate individuals review design plans and specifications for new construction and/or modification. This should involve the ROICC, cross-connection program coordinator, certified testers, etc. This will help ensure that BFPs are incorporated into the design phase.

- Ensure adequate funding is available to execute the program.

- Ensure program requirements are documented in a written instruction. Appendix D provides a template for such an instruction.

B. Program Staff

As addressed previously, various personnel will be utilized for "day-to-day" coordination and implementation of the program. This will include a designated program coordinator, certified testers, installation/maintenance personnel, ROICC personnel, etc. For those activities utilizing BOS contractors, BOS personnel may be used to implement the program. It is imperative that testers complete cross-connection control and backflow prevention certification training and hold a valid certificate. It is highly recommended that other disciplines also receive applicable training.

It is essential that all individuals associated with the execution of the program be fully cooperative and communicate with each other as they perform assigned duties.

Responsibilities of personnel assigned to implement the program are defined in detail throughout this User's Guide. In general, responsibilities include, but are not limited to, the following:

- Attend certification courses and other training courses to develop and maintain skills for implementing various aspects of this program. See Section II.I. for more detailed information.

- Pursue an aggressive program to identify, isolate, record, and correct cross-connections and other potential sources of water system contamination.

- Protect the water system from actual or potential cross-connections either by creation of an approved AG or installation of an approved BFP.

- Ensure that newly installed BFPs are certified for proper installation and operation. Ensure that the ROICC obtains certification of newly installed

BFPs associated with construction projects prior to acceptance of the completed project by the Navy.

- Certify BFPs for proper installation and operation on a routine basis at a minimum of every 6 or 12 months based on the class of hazard as discussed in Section II.C.

- Readily take corrective action to repair or replace defective BFPs.

- Review all plans and specifications relating to water systems to ensure that potential cross-connections are identified and that proper BFPs are installed.

- Efficiently implement the emergency plan if the drinking water system is contaminated.

- Maintain close coordination regarding program implementation with all reimbursable customers to whom water is supplied via intra-service support agreements (ISSAs) or utility service agreements with private parties. Unless otherwise indicated in the above agreements, responsibilities for funding and implementing the cross-connection control and backflow prevention program for such facilities rest with the owner(s) of the service lines and/or the water-using processes associated with such facilities.

- Ensure that information is gathered during the installation, certification, and maintenance phases by completing applicable field forms and that this information is maintained on a computerized database and made available to regulatory authorities upon request.

- If BOS contractor personnel are used to implement any portion of the program, ensure that appropriate wording is included in the BOS contract document to describe all actions necessary for rendering full compliance with program requirements including training and certification requirements as outlined in this document. Also ensure that the Government adequately performs quality assurance/quality control (QA/QC) functions to verify that the BOS contractor is satisfying specific contract requirements.

C. Reimbursable Customers/Tenants

Reimbursable customers will be expected to accomplish the following actions:

- Unless otherwise indicated in the previously mentioned agreements, fund and implement the cross-connection control and backflow prevention program for all facilities (including service lines, water-using processes, etc.) owned by the reimbursable customer/tenant.

- If retaining responsibility for implementing the program for their own facilities, ensure that a cross-connection control and backflow prevention program is developed and documented in a written fashion. See Appendix D for guidance on writing a program instruction.

- Submit a copy of all records to the designated Installation/host's cross-connection control and backflow prevention coordinator.

- Notify the Installation/host's cross-connection control and backflow prevention coordinator in writing if there is a change in water use within a facility. If the change results in a more severe degree of hazard and requires a different internal or external BFP to protect the drinking water system, appropriate corrective action will be taken within reasonable timeframes as mutually agreed upon by the host Activity and the reimbursable customer/tenant.

- Consult with the Installation/host's cross-connection control and backflow prevention coordinator if questions arise regarding cross-connection control and backflow prevention requirements for reimbursable customer/tenant facilities.

D. Users Other Than Reimbursable Customers

All users will be expected to fully cooperate to ensure that the cross-connection control and backflow prevention program is fully implemented. No user will knowingly create a cross-connection or alter or bypass an existing BFP. If there is any change in water use within a facility that might impact compliance with this program or if the user identifies any deficiency with an existing BFP, the user should preferably notify the Installation/host's cross-connection control and backflow prevention coordinator. If this is not possible, the user should notify the appropriate authority within the chain of command responsible for the facility. Ultimately, a work order should be submitted or an emergency service call made to correct the deficiency. [NOTE: The latter requirements regarding notification of change in water use or submittal of a work order to correct deficiencies with existing BFPs will not normally pertain to residential users or casual users (e.g., visitors, etc.) However, should the residential or casual user have reason to think that a change in water use or a deficiency with an existing BFP has occurred, the

user should notify the appropriate authority such as the Installation/host's cross-connection control and backflow prevention coordinator, Housing Director, facility manager, etc.]

V. CONCLUSION

The primary purpose of cross-connection control and backflow prevention is to help ensure that drinking water is safe for human consumption and other uses by rendering compliance with Federal, State, and local regulatory standards. The degree of enforcement of cross-connection control and backflow prevention procedures varies widely depending upon requirements of individual State or local regulatory agencies. Successful implementation of a cross-connection control and backflow prevention program requires good, effective communication and cooperation between all parties concerned. Decisions regarding the degree to which this User's Guide is actually adopted or modified for individual programs must be made by the Activity and Major Claimant with consultation, as needed, from the Engineering Field Division/Activity. These decisions may be impacted by the level of enforcement by the State or local regulatory agency and funding and manpower availability.

The information provided in this User's Guide, if fully implemented, should yield a cross-connection control and backflow prevention program that is in compliance with current requirements of most State or local regulatory agencies.

APPENDIX A

DEFINITIONS

APPENDIX A

DEFINITIONS

The following terms and definitions are compiled from various sources such as the manuals issued by the FCCCHR, AWWA, TREEO, etc. No individual reference source contains all of the following definitions. The wording of definitions may not exactly replicate the wording in reference manuals; however, the technical meaning of the definitions is accurate and is provided to assist in the interpretation and understanding of this User's Guide.

Air Gap (AG): A physical separation between the free flowing, unobstructed discharge end of a potable water supply pipeline and an open or non-pressure receiving vessel. An "approved air gap separation" shall be at least double the diameter of the supply line measured vertically above the top rim of the vessel and in no case shall the distance be less than one (1) inch.

Atmospheric Vacuum Breaker (AVB): A device containing a float-check valve, a check seat, and an air inlet port. When water flows through the device in the proper direction the float seals the air inlet port, preventing air from entering the system. With no water flow, or reversed flow through the chamber, the float will fall, forming a check valve. Air entering the system through the air inlet port breaks the vacuum and prevents backsiphonage.

Auxiliary Water Supply: Any water supply on or available to the premises other than the potable water supply normally used. Auxiliary waters may include water from another potable water supply or any natural source(s) such as a well, lake, spring, river, stream, harbor, reclaimed water (re-use water), or industrial fluids.

Backflow: The reversal of flow of undesirable (nonpotable) liquids, gases, or solids into the distribution piping of the potable water supply. This is created due to the existence of a pressure differential where the pressure on the nonpotable side is greater than the pressure on the potable side. There are two different types of backflow: backsiphonage and backpressure.

Backflow Preventer (BFP): A "backflow preventer" shall mean any approved device or assembly or piping arrangement (i.e., air gap) used to prevent backflow into a potable water system.

Backflow Preventer Assembly: An assembly has a resilient seated, full-flow shutoff valve before and after the BFP making it testable in-line. The assembly is shipped with the shutoff valves attached to the BFP. An assembly is labeled with the manufacturer's symbol, the size and model number, the working pressure, and the direction of flow. Parts for the approved assembly are provided for a minimum of 7 years after the sale of the assembly. The term "assembly" would refer to the RPZ, RPDA, DCVA, DCDA, and the PVB.

Backflow Preventer Device: A mechanical BFP with no built-in shutoff valves or test cocks. This definition is used in this User's Guide to differentiate a "device" from an "assembly" and would refer to the AVB, HBVB, and the DC.

Backpressure (Superior Pressure): A condition in which the pressure in a nonpotable system is greater than the pressure in the potable water distribution system. Superior pressure will cause nonpotable liquids to flow into the potable water distribution system through cross-connections.

Backsiphonage: Reversed flow of liquid caused by a partial vacuum in the potable water distribution system.

Bypass: A piping arrangement which allows water to flow around a BFP.

Certification of Personnel: The training and licensing process whereby a person is approved by the applicable regulatory authority to inspect and test BFPs and to accomplish surveys for identifying existing/potential cross-connections and recommending required corrective actions. Certification is required for inspectors/testers and is highly recommended for other disciplines such as the program coordinator, maintenance personnel, ROICC personnel, environmental personnel, and engineering or other Public Works personnel responsible for reviewing plans and specifications for new construction and/or modifications, etc.

Certification of BFPs: The process by which a BFP is approved for proper installation and operation via inspection and testing by a cross-connection control and backflow prevention representative.

Containment Protection: A BFP installed on a water service supply line external to a facility to confine potential contamination caused by a cross-connection within the facility. For freeze protection purposes, the BFP may be installed internal to the facility near the entrance point before any split-offs to water-using processes. For all practical purposes, the latter arrangement serves as external protection although being physically located inside the facility.

Contamination: An impairment to the quality of water which creates an actual hazard to the public health through poisoning or through the spread of disease by sewage, industrial fluids, or waste.

Continuous Pressure: The water is continuously applying pressure on the BFP.

Cross-Connection: Any physical arrangement whereby a public water system is connected, directly or indirectly, with any other water supply system, sewer, drain, conduit, pool, storage reservoir, plumbing fixture, or other device which contains, or may contain, contaminated water, sewage, or other waste or liquid of unknown or unsafe quality which may be capable of imparting contamination to the public water system as a result of backflow. Bypass arrangements, jumper connections, removable sections, and swivel or changeover devices through which, or because of which, backflow could occur are considered to be cross-connections.

Cross-Connection Control and Backflow Prevention: The use of approved assemblies, devices, air gaps, associated methods and procedures, etc., to prevent contamination or pollution of a potable water supply through cross-connections.

Degree of Hazard: The danger posed by a particular substance or set of circumstances. Degree of hazard is divided into health hazard and non-health hazard, both of which are defined below.

Double Check Valve Assembly (DCVA): An assembly composed of two single, independently acting, approved check valves, including tightly closing shutoff valves located at each end of the assembly and fitted with properly located test cocks.

Double Check-Detector Check Assembly (DCDA): A specially designed BFP composed of a line-sized approved DCVA with a specific bypass water meter and a meter-sized approved DCVA assembly to detect leakage or unauthorized water use.

Facility: Any individual building, structure, or outdoor recreational area to which potable water service is provided. This term does not refer to the land mass encompassed by the Navy or Marine Corps Activity.

Health Hazard: A cross-connection or potential cross-connection involving a contaminant in sufficient concentration to spread disease or cause death.

Hose Bibb Vacuum Breaker (HBVB): A device composed of a single, spring-loaded check valve and atmospheric venting feature which may be connected to a standard hose-threaded faucet for the purpose of preventing backflow through the hose bibb. This device does not have test cocks and is not approved by the University of Southern California FCCCHR.

Interconnection: Any system of piping or other arrangement whereby the public water system is connected directly with a sewer, drain, conduit, pool, storage reservoir, or other device which does or may contain sewage or other waste or liquid which would be capable of imparting contamination to the public.

Isolation Protection: To confine a potential source of contamination to the nonpotable system being served within a facility; for example, to install a BFP on a laboratory faucet or boiler feed line (sometimes called internal isolation).

Non-Health Hazard: A cross-connection or potential cross-connection involving any pollutant or contaminant (at low levels) that will not create a health hazard but will create a nuisance, or be aesthetically objectionable, if introduced into the potable water supply.

Nonpotable: Any liquid that is not safe for human consumption.

Non-Toxic: Not poisonous; a substance that will not cause illness or discomfort if consumed.

Outlet: The open end of a water supply pipe from which the water is discharged from the plumbing fixture.

Pathogen: A disease-causing agent or organism.

Person: Any individual, corporation, company, association, partnership, State, municipality, utility district, water cooperative, or Federal Agency.

Physical Disconnection (separation): Removal of pipes, fittings, or fixtures that connect a potable water supply to a nonpotable system or one of objectionable quality.

Plumbing: Any arrangement of pipes, conduits, tanks, receptacles, fixtures, equipment, and appurtenances used to produce, convey, and/or store drinking water inside a facility.

Potable: Water (or other liquids) that are safe for human consumption. In this User's Guide, potable water is referred to as drinking water.

Pressure Vacuum Breaker (PVB): An assembly that is similar to an AVB except that the checking unit "poppet valve" is activated by a spring and it comes equipped with two shutoff valves and two test cocks. This type of vacuum breaker does not require a negative pressure to react and can be used on the pressure side of a valve.

Public Water System: A system for the provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. Such term includes:

a. Any collection, treatment, storage, and distribution facilities under the control of the operator of such system and used primarily in connection with such system.

b. Any collection or pretreatment storage facilities not under such control that are used primarily in connection with such system.

Purveyor: The supplier and/or distributor of potable water (i.e., the owner of the public water system.)

Reduced Pressure Principle Assembly [also known as reduced pressure or reduced pressure zone (RPZ) BFP] : An assembly containing two independently acting approved check valves together with a hydraulic operating, mechanically independent pressure relief valve located between the check valves and at the same time below the first check valve. The unit includes properly located test cocks and tightly closing shutoff valves at each end of the assembly.

Reduced Pressure Principle-Detector Assembly (RPDA): A specially designed BFP composed of a line-sized approved RPZ with a specific bypass water meter and a meter-sized approved RPZ to detect leakage or unauthorized water use.

Reimbursable Customers: Those customers who purchase water from the water purveyor and reimburse the purveyor based on established rates or private party rates through an intra-service support agreement (ISSA). In the context of this User's Guide, this term will also apply to temporary customers such as construction contractors, etc., that utilize the public water system on a limited basis.

Relief Valve: A device designed to release air from a pipeline, or introduce air into a line if the internal pressure drops below atmospheric pressure.

Residential Dual Check Valve (DC): A device, consisting of two independently acting check valves, which is inserted directly in the water line normally at a meter box. This device is sized for lines 1.25 inches or smaller and would normally be used for single family or duplex residential service lines. This device has no test ports and for this reason is not approved by the University of Southern California FCCCHR. It is approved by the American Society for Sanitary Engineers (ASSE), however.

Service Connection: A piping connection between the water purveyor's main and a user's system.

Test Cock: An appurtenance on a BFP used when testing the BFP.

Toxic: Poisonous; a substance capable of causing injury or death. A toxin may be ingested, inhaled, or absorbed through the skin.

Water Distribution System: The water system as owned and operated by the Department of the Navy. This system includes all sources, facilities, and appurtenances such as valves, pumps, pipes, conduits, tanks, receptacles, fixtures, and other equipment used to convey, treat, or store potable water for consumptive use.

APPENDIX B

ACRONYMS

APPENDIX B

ACRONYMS

ASSE:	American Society of Sanitary Engineers
AG:	Air Gap
AVB:	Atmospheric Vacuum Breaker
AWWA:	American Water Works Association
BFP:	Backflow Preventer
BOS:	Base Operating Services
CCCDBMS:	Cross-Connection Control Database Management System
CFR:	Code of Federal Regulations
DC:	Residential Dual Check Valve
DCDA:	Double Check-Detector Check Assembly
DCVA:	Double Check Valve Assembly
FCCCHR:	Foundation for Cross-Connection Control and Hydraulic Research
HBVB:	Hose Bibb Vacuum Breaker
HDBK:	Handbook
ISSAs:	Intra-Service Support Agreements
MCON:	Military Construction
NAVFAC:	Naval Facilities Engineering Command
NFGS:	NAVFAC Guide Specifications
O&MN:	Operation and Maintenance Navy
OPNAVINST:	Instruction issued by the Office of the Chief of Naval Operations

OS&Y: Open Stem and Yoke

pH: Potential of Hydrogen

QA/QC: Quality Assurance/Quality Control

ROICC: Resident Officer in Charge of Construction

RPZ: Reduced Pressure Zone

RPDA: Reduced Pressure Principle-Detector Assembly

SDWA: Safe Drinking Water Act

TREEO: Training, Research and Education for Environmental Occupations

APPENDIX C

CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION PROGRAM INSTRUCTION TEMPLATE

1 Policy

The purpose of this instruction is to establish and enforce **ACTIVITY/FACILITY NAME** procedures and responsibilities for a cross-connection control and backflow prevention program for the potable water systems at **ACTIVITY/FACILITY NAME**. The cross-connection control and backflow prevention program is established for the purpose of detecting and preventing cross-connections that create or have the potential to create an imminent and substantial danger to public health by and from contamination due to cross-connection. The goal of the cross-connection and backflow prevention program is to ensure safe drinking water under all foreseeable circumstances.

2 Applicable Regulations

The following Federal, State and local regulations apply to **ACTIVITY/FACILITY NAME**:

Safe Drinking Water Act (SDWA), Public Law 93-523.
Cite Applicable State Drinking Water Regulations.
Cite Applicable Local Cross-Connection Control And Backflow Prevention Ordinances.

3 Reference

Cross-Connection Control and Backflow Prevention Program Implementation At Navy Shore Facilities, May 1998.
Environmental and Natural Resources Program Manual, OPNAVINST 5090.1B., Chapter 8.

4 Administration

This program has on-site personnel with designated areas of responsibility.

4.1 Program Director

The Program Director is responsible for the overall environmental program and will ensure its implementation.

Name:	Signature:
Title:	Location:
Code:	Phone:

4.2 Program Coordinator

The Program Coordinator is responsible for cross-connection control and backflow prevention policy matters and serves as the point of contact for site visits and inspections.

Name	Signature:
Title:	Location:
Code:	Phone:

4.3 Program Manager

The Program Manager is responsible for the day-to-day implementation of the cross-connection control and backflow prevention program.

Name:	Signature:
Title:	Location:
Code:	Phone:

4.4 Other Responsible Personnel (e.g. Medical Officer, Staff Civil, etc.)

The Activity/Facility will provide the number of signature blocks as necessary.

Name:	Signature:
Title:	Location:
Code:	Phone:

5. Procedures

5.1 New Facilities

New facilities are to be designed without cross-connections. The design must provide adequate backflow protection through the use of approved backflow preventers (BFPs). BFP selection should be based on the Degree of Hazard associated with the cross-connection. Plans and specifications for new facilities must be provided to **PROVIDE CODE AND/OR NAME** for technical review prior to construction.

Design changes to the potable water system (or any system making a direct or indirect connection to the potable water system) must be reviewed by **PROVIDE CODE AND/OR NAME** before being finalized.

All newly installed BFPs will be tested and certified before being placed into service.

5.2 Existing Facilities

A qualified inspector (certified tester) will perform a cross-connection control and backflow prevention survey of the facility. The survey will be performed annually and will include a review of the facility's entire internal water plumbing system, including the various outlets, water-using equipment, etc. From the data collected in the survey, the inspector shall identify:

- location of possible or actual cross-connections
- degree of hazard

- location and adequacy of existing BFPs
- need for installation of additional BFPs.

All existing BFPs will be identified, certified for proper installation and operation, and placed into an inventory database during the initial survey of the facility. A history file for each building will be established during the initial survey. This file will contain results of the building survey, a description and location of each potential cross-connection site, and a list of each nonpotable liquid system and potable water system connections. This file will be updated annually or when changes are made to the system.

BFPs will be certified using test equipment and test procedures conforming to those outlined in the latest edition of the "Cross-Connection Control Manual" published by the Foundation for Cross-Connection Control and Hydraulic Research (FCCCHR) or Manual M14 published by American Water Works Association (AWWA). Only tests performed by certified testers will be considered official tests. BFPs will be tested and certified on an annual basis for BFPs with a low hazard classification and every 6 months for BFPs with a high hazard certification.

When cross-connections are identified, the problem will be eliminated or isolated by installing an approved BFP. Installation of the BFP will comply with the criteria set forth by Federal, State and local codes/regulations (see Section 2), and the manufacturer's recommendations. Termination of water service is required in situations where illness or death is attributable to the lack of, or inadequate maintenance of, a BFP.

Recommendations of the inspector will be forwarded to the Program Manager or his/her designee for implementation. When feasible, all newly installed BFPs will be tested and certified prior to being placed into service. If the device to be installed will cause a reduction in water pressure, building occupants will be notified. Any backflow device to be installed will be selected from the most current list of approved cross-connection control devices (see Section 10). A licensed backflow tester will complete testing and certification, as necessary, prior to placing the system back in service. All certificates will be forwarded to the Program Manager. Copies of certificates will be maintained in the history file.

6 Records

6.1 Locations of Devices and Types

Historical files will be maintained for each facility. This file will contain results of the building survey, a description and location of each potential cross-connection site, and a list of each non-potable liquid system and potable water system connections. This file will also include a list of BFP device locations and types. This file will be updated annually or when changes are made to the system.

6.2 Testing and Maintenance

Records of BFP device inspections, tests, repairs, overhauls, or replacements will be maintained by **ACTIVITY/FACILITY NAME** for a period of not less than 10 years. These records will include documentation to verify that BFPs were properly installed, certified, and maintained.

7 Notification

7.1 Testing Due

The certification interval for the BFPs will depend on the degree of hazard. For high hazard BFPs, testing and certification will be performed every 6 months, at a minimum. Low hazard BFPs will be tested and certified every 12 months, at a minimum. The certification schedule will be maintained with the building records. The Building Manager will be informed when testing is to take place.

7.2 Test Results

Test results will be forwarded to the Program Manager, the Building Manager, and **ENTER OTHERS, AS REQUIRED**.

7.3 Violations

When violations are detected, the Program Manager and the Building Manager will be notified. If necessary, the water purveyor will be notified of the violation.

7.4 Termination or Denial of Service

If termination of water service is required, a letter will be issued to the building manager of the facility stating the nature of the hazardous condition that threatens the safety of the water system. The building manager will be advised that it is necessary to take steps, including termination of water service, to minimize the danger of contamination and failure to take action could result in illness or death. Water service will not be restored until the deficiency has been corrected or eliminated. Service will be terminated immediately if illness or death can be attributed to a lack of BFPs or a lack of BFP maintenance.

8 Reporting

Following testing and certification all records will be updated and a report will be filed with **PROVIDE CODES AND/OR NAMES.** If required, a report will also be filed with the water purveyor.

9 Backflow Prevention Device Tester List

BFPs will be certified using test equipment and test procedures conforming to those outlined in the latest edition of the “Cross-Connection Control Manual” published by the FCCCHR or Manual M14 published by the AWWA.

10 Approved Devices List

All BFPs to be installed will be approved by the State or local agencies.

11 Consumer Education Literature

General consumer education literature can include posters, informational flyers, and articles to be printed in the base newsletter and/or newspaper on a periodic basis

Annual training in cross-connection control and backflow prevention will be provided to industrial facility occupants. Training can be incorporated into general standup training (see Appendix D for an example).

APPENDIX D

CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION AWARENESS TRAINING

APPENDIX D

CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION AWARENESS TRAINING

All personnel employed by the facility must receive minimal awareness training to inform them of the importance of cross-connection control and backflow prevention, their role in cross-connection control, and health hazards associated with cross-connections. At a minimum, the following items should be covered. Modifications to the general awareness training should be made to reflect circumstances specific to the Installation/Activity.

The program should discuss the following:

1. What is a cross-connection?

A cross-connection is any direct (such as with plumbing) or indirect (such as with hydrant hose) connection between a potable (drinking) water source and a nonpotable source of water or wastewater. Drinking water is any part of the Activity potable water system whether it comes from a water fountain or a fire hydrant.

2. What is a cross-connection control?

Cross-connection control is a system by which the above connections are eliminated or prevented from ever happening.

3. What is backflow?

Backflow is the flow of nonpotable water (contaminated or potentially contaminated water) into the potable water system. It can happen in either of two ways: backpressure or backsiphonage. Backflow from backpressure occurs when the pressure from a system is greater than the potable water system pressure and is forced into the drinking water supply. Backsiphonage occurs when the potable water supply system experiences negative pressure and nonpotable water is drawn or sucked into the potable water system. For either type of backflow to occur there must be either a direct or indirect connection to the potable water system.

4. What is backflow prevention?

Sometimes, particularly in an industrial setting, a cross-connection must be made. When this is the case, a mechanical device called a backflow preventer must be used. These devices are used to prevent the flow of nonpotable (contaminated or potentially contaminated) water/wastewater into the potable water system. There are many types of backflow preventers, and the type that is installed in a particular setting is based on the degree of hazard.

5. What is the best way to prevent backflow?

The best way to prevent backflow is to eliminate any connection, direct or indirect, between the potable water system and the nonpotable water system. This means rolling

hoses when not in use, not submerging hoses when filling tanks, trailers, and waste boxes, and not connecting any machinery or equipment, including portable (field use) equipment to fire hydrants without installing a temporary backflow prevention device. When this is not possible, the Activity's Cross-Connection Program Coordinator **PROVIDE CODE AND/OR NAME** at **PROVIDE PHONE NUMBER** must be contacted to review the situation. Remember DO NOT connect anything to the potable water system that you wouldn't want to drink.

6. What is an example of a cross-connection?

An exterminating contractor created a cross-connection when diluting highly toxic insecticide, chlordane, by submerging a garden hose into this material. A break in the water pressure resulted in a backsiphonage of the poisonous contents of the drum through the hose service connection and into the water supply. This incident illustrates the danger of cross-connection and indicates the need for the provision of backflow preventers. If you see similar cases, the Activity's Cross-Connection Program Coordinator **PROVIDE CODE AND/OR NAME** at **PROVIDE PHONE NUMBER** must be contacted to review the situation.

APPENDIX E

REQUEST FORM FOR PROPOSED CHANGES TO THE CROSS-CONNECTION CONTROL AND BACKFLOW PREVENTION PROGRAM IMPLEMENTATION AT NAVY SHORE FACILITIES

Proposed changes to this User's Guide shall be submitted using the CHANGE REQUEST FORM on page E-3. Change requests shall include specific recommended change wording, with detailed rationale or justification. Change requests shall also identify known impacts of the recommended change upon related reference documentation. Completed forms should be submitted directly to the Naval Facilities Engineering Service Center (NFESC) Code 426 at the following address:

Naval Facilities Engineering Service Center
Attn: Abe Nachabe Code 426AN
1100 23rd Ave
Port Hueneme CA 93043

Electronic forms may be transmitted by e-mail to: anachab@nfesc.navy.mil

CHANGE REQUEST FORM	
MANUAL REVISION/CHANGE AGAINST WHICH RECOMMENDED CHANGE IS WRITTEN:	ORIGINATING ACTIVITY: (ADDRESS)
PRIMARY MANUAL CHAPTER/SECTION/PARAGRAPH IMPACTED BY RECOMMENDED CHANGE:	
OTHER SECTIONS AFFECTED:	POINT OF CONTACT: COMMERCIAL: DSN:
RECOMMENDED CHANGE	
RATIONALE/JUSTIFICATION	
RELATED DOCUMENTATION: (This includes any references or documents which may be affected by recommended change).	
ORIGINATOR'S SIGNATURE:	DATE