Fermilab

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Memorandum

February 1, 2008

To: Bruce Chrisman

From: William Griffing

Subject: Revised FESHM Chapter 8050 – Domestic Water Protection

FESHM chapter 8050, "Domestic Water Protection," is a complete rewrite of the previous chapter to include major changes in the domestic water supply system at the laboratory. This chapter also incorporates FESHM Chapter 8051, Protection of Domestic Water Supplies: Backflow Preventions/Cross-Connections, as the appendix. FESHM Chapter 8051 will be eliminated. This chapter has been posted for lab-wide review and all comments were address.

After final approval, please return this approval page to Elizabeth Bancroft at MS119 for posting on the web.

Encl.

Recommended for Approval:

Bruce Chrisman — Date 2/4/08

Approved:

Piermaria Oddone — Date 2/4/08

DOMESTIC WATER PROTECTION

INTRODUCTION

Fermilab has two separate drinking water systems. One is a community water system from the City of Warrenville that serves the majority of the site. The second includes semi-private system that serves one small facility (Site 29).

This chapter describes the organizational responsibilities for all elements of Fermilab's domestic water supply systems and general procedures for construction, maintenance and monitoring in accordance with the IEPA and IDPH.

APPLICABLE STANDARDS AND REFERENCES

Safe Drinking Water Act, 42 U.S.C. 300 *et seq.*

Code of Federal Regulations, Title 40 Parts 141 and 142, National Primary Drinking Water Regulations.

State of Illinois Rules and Regulations, Title 77: Public Health, Chapter: Department of Public Health, Subchapter r: Water and Sewage, Part 900: Drinking Water Systems.

State of Illinois Rules and Regulations, Title 77: Public Health, Chapter: Department of Public Health, Subchapter r: Water and Sewage, Part 920: Illinois Water Well Construction Code.

State of Illinois Rules and Regulations, Title 77: Public Health, Chapter: Department of Public Health, Subchapter r: Water and Sewage, Part 925: Illinois Water Well Pump Installation Code.

State of Illinois Rules and Regulations, Title 35: Environmental Protection, Subtitle F, Public Water Supplies, Chapter I: Pollution Control Board.

State of Illinois Rules and Regulations, Title 35: Environmental Protection, Subtitle F, Public Water Supplies, Chapter II: Environmental Protection Agency, Parts 651-654 Technical Policy Statements.

State of Illinois, County of Kane, Ordinance No. 91-101, Water Supplies/Wells.

State of Illinois, County of DuPage, Ordinance No. OH-0002-90, Chapter 34, DuPage County Code, DuPage County Health Department Private Water Supply Ordinance.

Fermilab Environment, Safety and Health Manual, Chapter 8025, Wastewater Discharge To Sanitary Sewers, January 1996.

DEFINITIONS

Certified Operator - shall supervise the treatment and distribution facilities of the water supply.

Community Water System - a public water system which serves at least 15 service connections used by residents or regularly serves at least 25 residents for at least 60 days a year.

Illinois Department of Public Health (IDPH) - for the purpose of this chapter the IDPH is the government agency which dictates the requirements for maintaining a safe Non-Community Drinking Water System. Enforcement of these requirements has been delegated by the IDPH to the appropriate county health departments. An agreement between Fermilab and DuPage and Kane Counties places regulation of both site NTNC supplies with DuPage County.

Illinois Environmental Protection Agency (IEPA) - for the purpose of this chapter, the IEPA is the government agency which dictates the requirements for maintaining a safe Community Water System.

Semi-Private Drinking Water Systems - a water supply which is not a public water system, yet which serves a segment of the public other than an owner-occupied single family dwelling.

Public Water System - a system for the provision to the public of piped water for human consumption, if the system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days per year. The term "Public Water System" includes any collection, treatment, storage or distribution facilities under the control of the operator of such system and used primarily in connection with such system and any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system.

RESPONSIBILITIES

Environment, Safety & Health Director

- act as a liaison between the government agencies and Fermilab and will provide technical support to the FESS Operations, Engineering and Environment Officer.
- prevent backflow into the domestic water supply system by assuring that:

1. All cross-connections are removed; or approved cross-connection control devices are installed for control of backflow or back siphonage.
2. Cross-connection devices are installed in accordance with the manufacturer's instructions, and applicable State and Federal regulations.
3. Cross-connection control devices are inspected at least annually by a person approved by the agency as a cross-connection control device inspector (CCCDI). The inspection of mechanical devices shall include physical testing in accordance with the manufacturer's instructions and any applicable State or Federal Regulations.

Facilities Engineering Services Section Head – oversight of the following group responsibilities.

Operations Group

- responsible for the maintenance of the Laboratory's public water system infrastructure. Acts as the liaison to the City of Warrenville.
- responsible for the operation, maintenance and testing of semi-private water systems.

Engineering Group

- responsible for water supply system design and modification in compliance with applicable standards.
- give notice to the Division/Section to install an approved device in accordance with applicable State and Federal regulations or if in the judgment of the Facilities Engineering Services (FES) Section it is necessary for the safety of the Laboratory water supply system.
- include provisions for cross-connection control devices in the plans for all new installations served by the domestic water supply. This provision shall comply with any applicable State and Federal codes or regulations.
- provide evaluation and/or inspection of plans and drawings in order to determine the type of backflow preventer, if any, required on new or proposed installations utilizing the Laboratory domestic water supply system.
- obtain the contractor for conducting inspections, at least annually, of installed cross-connection control devices. This contractor must be approved by the agency as a cross-connection control device inspector (CCCDI).

Environmental Officer

- responsible for notification to ES&H Section Head of system additions or modifications.

Divisions and Sections Head

- initiating timely requests for supply system design or modification to the Facilities Engineering Services Section Engineering Group.
- allowing no one within their organization, or contractor, to effect changes to the Laboratory domestic water supply system, regarding new or proposed installations, without prior review and approval of plans or drawings by the FES Section.
- allowing no one within their organization, or contractor, to establish, maintain, or permit to be established or maintained, any connection whereby an auxiliary or emergency water supply, other than the Laboratory potable water supply or distribution system, may enter the potable water supply or distribution system, unless the method of connection, alternative water supply, and use of the alternative supply have been approved by the FES Section.

PROCEDURES

This chapter pertains to all areas of the Laboratory where employees, users, contractors and subcontractors may utilize the drinking water systems.

Fermilab operates, maintains and monitors its drinking water systems in accordance with the applicable referenced standards.

1. All proposed new water supply construction or modifications to existing supply infrastructure by division/sections shall be coordinated with the FESS Engineering Group through submission of an Application for Modifications or Additions to Fermilab Water Supply Systems. An application shall be submitted early in the decision process prior to work for modification of any Fermilab water supply system. It applies to work done by Fermilab employees as well as work done by subcontractors. Minor repair work to piping that does not change piping configuration does not require an application.

2. A copy of the application shall be forwarded to the ES&H Section Head if modification includes construction or abandonment of a well. Early submission is necessary so that the appropriate notification can take place.

3. The ES&H Section Head will transmit all necessary material to the appropriate agency. All necessary permit approvals are required before construction or modified system startup can begin.

4. FESS Operations Group and Environmental Officer shall ensure compliance of all existing, new or modified supply systems with applicable drinking water standards.

INSTRUCTIONS FOR COMPLETING THE APPLICATION FOR MODIFICATIONS OR ADDITIONS TO FERMILAB WATER SUPPLY SYSTEM INFRASTRUCTURE

1. The purpose of this application is to improve communication within the Laboratory for the supply and monitoring of drinking water to Fermilab.

2. The application will be used as evidence that a review was made of proposed work and complies with Fermilab ES&H Manual Chapter 8050 - "Drinking Water Protection."

3. All portions of the form shall be filled in as completely as possible. The completed application, with all required documentation, shall be transmitted to the FES Engineering Group.

4. A task number will be required for charge back (minimum 2 hours), for initial review and field visit, inspection at completion, and configuration control.

5. Included with the application shall be the following documentation:

   - copy of requisition,
   - location of project on Fermilab Vicinity Plan,
   - proposed modifications to water supply system in the form of scaled drawings consisting of plumbing plans (indicating location of proposed work), along with an orometric or riser diagram indicating modifications to existing water supply system.

Appendix

PROTECTION OF DOMESTIC WATER SUPPLIES
BACKFLOW PREVENTION: CROSS-CONNECTIONS

PURPOSE

A. The purpose of this policy is to protect the Laboratory potable water infrastructure from contamination or pollution by isolation or containment methods, within the buildings water supply system, of contaminants or pollutants which could backflow through the service connection into the Laboratory potable water infrastructure.

B. To promote the elimination or control of existing cross-connections, actual or potential, between the site potable water system and any other non-potable water system, plumbing fixture, source or system containing substances of unknown or questionable quality.

C. To provide for the maintenance of a continuous program of cross-connection control to prevent the contamination or pollution of the Laboratory potable water infrastructure.

SCOPE

All Divisions and Sections.

APPLICABLE STANDARDS

1. Illinois Environmental Protection Agency Regulations; EPA Subtitle F: Public Water Supplies Title 35: Environmental Protection.

2. Illinois Plumbing Code.

PERSONS QUALIFIED TO USE THE PROCEDURE

Not Applicable.

DEFINITIONS

The following definitions shall apply to the application of this policy.

Agency - the Illinois Environmental Protection Agency.

Approved - backflow prevention devices or methods approved by the the Research Foundation for Cross-Connection Control of the University of Southern California, American Water Works Association, American National Standards Institute, or certified by the National Sanitation Foundation.

Auxiliary Water System - source of water outside of the Laboratory potable water supply system.

Backflow - the flow of water or other liquids, mixtures, or substances into the distribution pipes of a potable water system from any source other than the intended source of the potable water supply.

Backflow Prevention Device - any device, method, or type of construction intended to prevent backflow into a potable water system. All devices used for backflow prevention at the Laboratory must meet all applicable State and Federal Standards.

Containment - the use of a backflow prevention device, installed on the domestic water service to any building, in a manner as to isolate the building from the domestic water supply, in the event of a backflow situation.

Contamination - the introduction into water of micro-organisms, chemicals, wastes, or wastewater in a concentration that makes water unfit for its intended use.

Cross-Connection - any connection through which a supply of potable water could be contaminated or polluted.

Domestic Water Supply System or Distribution System - all mains, piping and plumbing fixtures owned or maintained by the Laboratory, through which water is obtained and distributed to Laboratory personnel and the public, including wells and well structures, pumping stations, reservoirs, storage tanks and appurtenances, collectively or severally, actually used or intended for use for the purpose of furnishing potable water.

Double Check Valve Assembly - an assembly composed of a single, independently acting check valves, including tight shutoff valves located at each end of the assembly and suitable connections for testing the water-tightness of each check valve.

Equipment means, but is not limited to, any machinery, tool, device, appurtenance, fixture, or experiment, which is connected to the domestic water supply system.

FES Section - for purposes of this policy, the official custodian responsible for the control of the premises supplied by the domestic water system.

Fixed Air Gap - the unobstructed vertical distance through the free atmosphere between the water discharge point and the flood level rim of the receptacle.

High Hazard Situation - "severe": (as used to qualify "health hazard") means a hazard to the health of the user that could be expected in death or significant reduction in the quality of life (SMPWCR - Definition 12).

Inspection - a plumbing inspection to examine carefully and critically all materials, fixtures, piping and appurtenances, appliances and installations of a plumbing system for compliance with requirements of the Illinois Plumbing Code.

Isolation - the use of a backflow prevention device, installed on the domestic water service to any process, equipment, or fixture, in a manner as to isolate the process, equipment or fixture from the domestic water supply, in the event of a backflow situation.

Laboratory or Lab - Fermi National Accelerator Laboratory.

Low Hazard Situation - "pollution": the presence of any foreign substance (organic, inorganic, radiological or biological) in the water that tends to degrade its quality so as to constitute, reduce or impair the usefulness of the water (ICCCH -Definition 18).

Medium Hazard Situation - "contamination": An impairment of the quality of the water by entrance of any substance to a degree which could create a health hazard (ICCCH - Definition 9).

Non-potable water - water not safe for drinking, personal or culinary use as determined by applicable State and Federal regulations.

O & M (Operations and Maintenance) - for purposes of this policy, the group within the Facilities Engineering Services Section responsible for the supply of domestic water to the Lab, encompassing all wells and distribution lines up to and including the service connection shut-off valve or backflow prevention device to any premises at the Lab.

Plumbing - the actual installation, repair, maintenance, alteration or extension of a plumbing system by any person, division/section or contractor. Plumbing includes all

piping, fixtures, appurtenances and appliances for a supply of water for all purposes, from the source of domestic water supply on the premises or from the main supply line within and about any building or buildings where a person or persons live, work or assemble. Plumbing includes all piping from discharge of pumping units, to and including pressure tanks in water supply systems. Plumbing includes all piping, fixtures, appurtenances and appliances for a building drain and a sanitary drainage and related ventilation system of any building or buildings where a person or persons live work or assemble, from the point of connection to such a building drain to the building sewer or private sewage disposal system five feet beyond the foundation walls.

Pollution - the presence of any foreign substance(organic, inorganic, radiological, or biological) in water that tends to degrade its quality so as to constitute a hazard or impair the usefulness of the water.

Potable Water - water which meets the applicable State and Federal regulations for drinking, culinary and domestic purposes.

Potential Cross-Connection - a fixture or appurtenance with threaded hose connection, tapered spout, or other connection which would facilitate extension of the water supply line beyond its intended termination point.

Process - any activity found at the laboratory utilizing the domestic water supply system as a source of process fluid(s), or equipment that involves the use of the domestic water supply system in the execution of a designed mechanical function.

Process Fluid(s) - any fluid or solution which may be chemically, biologically or otherwise contaminated or polluted in a form or concentration such as would constitute a health, pollution or system hazard if introduced into the domestic water system. This includes but is not limited to:

a. polluted or contaminated waters.
b. process waters
c. used waters originating from the domestic water supply system which may have deteriorated in sanitary quality.
d. cooling waters.
e. questionable or contaminated natural waters taken from wells, lakes, streams, or irrigation systems.
f. chemicals in solution or suspension.
g. oils, gases, acids, alkalis, and other liquid and gaseous fluids used in industrial or other processes, or for fire fighting purposes.

Reduced pressure zone principal backflow prevention device (RPZ) - a device containing a minimum of two independently acting check valves together with an automatically operated pressure differential relief valve located between the two check valves. During the normal flow and at the cessation of normal flow, the pressure between the two checks shall be less than the supply pressure. In case of leakage of either valve the differential relief valve, by discharging to the atmosphere, shall operate to maintain the pressure between the check valves at less than the supply pressure. The unit must include tightly closing shutoff valves located at each end of the device, and each device shall be fitted with the properly located testcocks.

Service connection - the connection to the domestic water supply system, including all fittings and appurtenances, through which water is supplied to any equipment, process plumbing fixture, or outlet for domestic water.

Survey - the collection of information pertaining to the Laboratory's piping system regarding the location of all connections to the domestic water supply system, and must include the location, type and most recent testing date of all cross-connection control devices and methods, located within the domestic water supply system.

User's - any water system serving the premise, commencing at the outlet side of the service connection shutoff valve.

Water System - any water system serving the premise, including but not limited to; Domestic (DCW), Industrial Cooling Water (ICW), Deionized Water (DI), Hot Water Heating Supply and Return (HWHS&R), Dual Temperature Water Supply and Return (DTWS&R), Chilled Water Supply and Return (CHS&R), Low Conductivity Water Supply and Return (LCWS&R), Pond Water Supply and Return (PWS&R), Mixed Domestic Water (MIXDW)-tempered domestic water, Lower Level Heating Supply and Return (LLHRS&R), Lower Level Cold Water (LLCW)-domestic.

Well or Wells refers to the source of domestic water pumped from the ground, utilized in areas of the Lab, either in its treated(chlorinated) or untreated form.

PROCEDURES

Cross-Connection Control Program Application

This policy shall apply to all areas of the Laboratory served by the domestic water supply system.

1. Surveys and Investigations

a. It shall be the responsibility of the FES Section to conduct surveys and investigations of all areas of the Laboratory where potable water is supplied, to determine whether actual or potential hazards to the water supply exist. These surveys shall be repeated at least every two years, or as the FES section determines it is necessary. Records of such surveys shall be available through the FES Section. Surveys may be accomplished through one or more methods, including inspection of lab premises, or the review of annual maintenance testing records. Prior to the commencement of physical survey activities, notice will be given to the responsible division/section and building manager.

b. It shall be the responsibility of the FES Section to arrange periodic surveys of water use practices at the Laboratory, to determine whether there are actual or potential cross-connections to the domestic water system, through which contamination or pollution could occur.

2. Prohibited Connections

a. Connections between the Laboratory domestic water supply system and other systems or equipment containing water or other substances of unknown or questionable quality are prohibited, except when and where an approved cross-connection control devices or methods are installed, tested, and maintained to insure proper operation on a continuing basis.

b. No connection shall be permitted between the Laboratory water supply system and any other water supply not of equal or better bacteriological and chemical quality, as determined by inspection and analysis by the FES Section.

c. There shall be no arrangement or connection by which contamination or pollution may enter the Laboratory domestic water supply system.

3. Where Protection is Required

a. An approved backflow prevention device shall be installed on a water service line to a buildings domestic water supply system when, in the judgment of the FES Section or their authorized representative, actual or potential hazards to the Laboratory water supply may exist.

b. Wells serving any premises of the Lab as a source of potable water shall, through the installation of approved backflow prevention devices, protect the aquifer supplying the water, from pollution or

contamination. The means of protection shall be applied in a manner as to provide protection of the aquifer, at the well head.

c. An approved backflow prevention device shall be installed on each water service line to a buildings domestic water system where the following conditions exist.

1. Buildings where any substance or process exists which can create an actual or potential hazard to the Laboratory domestic water supply system.

2. Buildings having internal cross-connections that in the judgment of the FES Section are not correctable or intricate plumbing arrangements exist which make it impractical to determine whether or not cross-connections exist.

3. Buildings having a repeated history of cross-connections being established or re-established.

d. An approved backflow prevention device shall be installed on the water service line to any equipment or process, when in the judgment of the FES Section or their representative, actual or potential hazards to the Laboratory domestic water supply system may exist.

4. Type of Protection Required

a. The type of protection required shall depend on the degree of hazard which exists as follows:

(i) An approved fixed airgap or an approved RPZ backflow prevention device shall be installed where the Laboratory domestic water supply system may be contaminated causing a "high hazard situation."

(ii) An approved fixed airgap or an approved prevention device shall be installed where the laboratory domestic water supply system may be contaminated causing a "medium hazard situation."

(iii) An approved fixed proper airgap separation or an approved RPZ backflow prevention device, or vacuum breaker of all approved types shall be installed where the Laboratory domestic water

supply system may be polluted with the substances that could cause a "low hazard situation."

b. Where a domestic water supply is used for a fire protection system, RPZ backflow preventers shall be installed between the fire sprinkler system and the domestic water supply system when:

(i) Water pumped into the system from another source may be connected to the sprinkler system.

(ii) Piping material used for the sprinkler system is not approved for potable use.

5. Backflow Prevention Devices

a. All backflow prevention devices or methods required by this policy shall comply with all applicable State and Federal codes or regulations related to these devices.

b. The installation of approved devices shall be made in accordance with all applicable regulations or industry specifications. All installations shall be made in accordance with the State of Illinois Plumbing Code. Maintenance shall be performed as recommended by the manufacturer of the device. Maintenance manuals for each device shall be available on-site.

6. Maintenance/Testing/Repair

a. It shall be the duty of the FES Section to have inspections, tests, maintenance and repairs made in accordance with the following schedule or more often where inspections indicate a need or are specific in the manufacturers instructions.

(i) Double check valve assembles shall be inspected and tested for tightness at the time of installation and at least annually thereafter. Required service shall be performed immediately.

(ii) Reduced pressure zone principal backflow prevention devices shall be tested at least annually or more frequently if recommended by the manufacturer.

b. Testing shall be performed by a person who has been approved by the Agency as competent to service the device with the use of approved testing equipment. Proof of approval shall be in writing.

c. Whenever backflow prevention devices required by this policy are found to be defective; they shall be repaired or replaced immediately.

7. Records

a. Records submitted to the Laboratory shall be available for inspection and/or auditing purposes by the Department of Energy (DOE) or the Agency, in accordance with appropriate DOE Orders and any State or Federal regulations. As required by the Illinois Plumbing Code, Fermilab shall forward inspection records annually to the City of Warrenville for their information.

b. Each device will have a tag attached listing the date of the most recent test, name and approval number of the CCCDI, and type and date of repairs.

c. A maintenance log will be maintained by the FES Section. The maintenance log will include:

1. Date of each test
2. Name & approval number of the CCCDI performing the inspection or test.
3. Test/inspection results.
4. Repairs or servicing required.
5. Repairs and date completed.
6. Services performed and date completed.
7. Location of device noted on R.P.I.floor plan.
8. Distribution water source.
9. Application (Containment/Isolation).
10. Manufacturers name.
11. Serial number of device.
12. Model number of device.
13. Size of device.
14. Installation date.

8. Booster Pumps

a. Where a booster pump has been installed on the service line to or within any premises, the pump shall shut-off the booster pump when the pressure in the service line on the suction side of the pump drops to 20 psi or less.

b. It shall be the duty of Operations and Maintenance to maintain the low pressure cut-off device in proper working order, and to verify at least once a year that the device is operable.

9. Corrective Actions

a. The FES Section is authorized to issue a notice to he appropriate division/section official and building manager, requesting that immediate corrective action(s) be taken to the water service supplying any process, equipment, or building where a connection in violation of this policy exists. This notice will include a brief description of the problem, immediate actions to be taken, and a recommendation for permanent corrective action. If the interruption of water service was deemed necessary by the FES Section, water service to the aforementioned process, equipment, or building shall not be restored until such conditions have been eliminated or corrected in compliance with the provisions of this Policy.

b. Nothing within this policy shall prevent the FES Section from taking such other action as it deems necessary to prevent or remedy a violation of this policy.

REFERENCES

1. Illinois Environmental Protection Agency Regulations, 1985; Chapter II: EPA Subtitle F: Public Water Supplies. Title 35: Environmental Protection.

2. Illinois Plumbing Code, 1986. Illinois Department of Public Health.

3. Illinois Cross-Connection Control Handbook, 1986. Printed by the Illinois Environmental Protection Agency in cooperation with the Illinois Department of Public Health.

4. Manual of Cross-Connection Control, Eighth Edition, 1988. Foundation for Cross-Connection Control and Hydraulic Research.

5. Cross-Connection Control Manual, 1989. United States Environmental Protection Agency, Office of Water.