Fermilab

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Memorandum

September 28, 2006

To: Bruce Chrisman

From: William Griffing

Subject: Revised FESHM Chapter 8025 – Wastewater Discharge to Sanitary Sewers

Enclosed you will find revised FESHM chapter 8025 "Wastewater Discharge to Sanitary Sewers." This chapter includes the following modifications:

1. Simplification of language for better readability
2. Change in internal discharge limits reflecting modified discharge rates to both municipalities
3. Incorporation of extended utility to D0
4. Update/Clarification to FESS utility modification form

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

Encl.

Recommended for Approval:

Bruce Chrisman — Date: 9/29/06

COPY

Approved:

Piermaria Oddone — Date: 10/9/06

WASTEWATER DISCHARGE TO SANITARY SEWERS

INTRODUCTION

Discharges to sanitary sewerage systems are regulated by the Illinois Environmental Protection Agency (IEPA) under authority delegated to the state by the U.S. Environmental Protection Agency. Ultimate authority is under the 1972 Clean Water Act (CWA) and amendments passed in 1977 (see APPLICABLE STANDARDS, below, for a complete list of state and federal standards). Regulations apply to every user of a sewerage system, and forbid the discharge of pollutants that might pass through publicly owned treatment works (POTW) untreated, that could create an unsafe situation for POTW workers or that might interfere with the operations of the POTW.

Illinois regulates the use of the sanitary sewerage system by enforcing the federal pretreatment program. Fermilab discharges are subject to discharge standards set by federal, state, and local regulations and ordinances. Effluents are conveyed to POTW facilities in Batavia and Warrenville/Naperville, and are subject to discharge limits set by municipal ordinance (see Appendix A for specific limits). Fermilab also holds a pretreatment permit to release treated effluent to the Batavia sanitary sewerage system from the Central Utility Building (CUB) ion regeneration process. This form requires periodic analysis and reporting to IEPA.

This chapter describes procedures intended to protect the integrity of the Fermilab sanitary sewer system, and to ensure that discharge limits are not exceeded at the point where our discharge enters the public sewerage systems, i.e., at the Fermilab site boundaries.

APPLICABLE STANDARDS

Illinois Plumbing Code at 77 Illinois Administrative Code (IAC) Chapter 890
Illinois NPDES regulations at 35 IAC Subtitle D
Illinois EPA Pre-treatment permit #2005-EP-4233
Clean Water Act of 1972 and 1977 Amendments
City Codes for Batavia and Warrenville
DOE Order 5400.5

DEFINITIONS

Derived Concentration Guide: The concentration of a radionuclide in air or water that, under conditions of continuous exposure for one year by one exposure mode (i.e., ingestion of water, submersion in air, or inhalation), would result in an effective dose equivalent of 100 mrem (1 mSv). DCGs do not consider decay products when the parent radionuclide is the cause of the exposure (DCG values are presented in Chapter III of DOE Order 5400.5).

Effluent: Any wastewater discharged, directly or indirectly, to the waters of the State (e.g., via a storm sewer or a sanitary sewer).

Neutralization: Decreasing the acidity or alkalinity of a substance by adding alkaline or acidic materials.

pH: A measure of hydrogen ion concentration in an aqueous solution. Solutions with a pH between 0 and 7 are acidic and solutions with a pH between 7 and 14 are basic.

Pollutant: Any substance introduced into the environment that adversely affects the usefulness of the resource.

Pollutant Load: The total amount of a pollutant in any given volume of wastewater (Concentration x Volume).

Pollution: The presence of matter or energy whose nature, location, or quantity produces undesired environmental effects. Under the CWA, the term is defined as a man-made or man-induced alteration of the physical, biological, or radiological integrity of water.

Pretreatment: Any process used to reduce a pollutant load before it enters the sewer system. Pretreatment of effluents requires a pretreatment permit from IEPA. Some examples of pretreatment might include neutralization, filtration, etc.

Publicly Owned Treatment Works (POTWs): A waste treatment works owned by a state or local government unit.

Sanitary Sewer: A sewer which carries sewage. Storm, surface, and ground waters are intentionally not admitted.

Sewage: The waste and wastewater produced by residential and commercial establishments and discharged into the sewers.

Waste Treatment Plant: A facility containing a series of tanks, screens, filters, and other processes by which pollutants are removed from water.

Wastewater: The spent or used water from individual homes, a community, a farm, or an industry that contains dissolved or suspended matter.

Vulnerability Analysis (VA): Formal analysis of any process that rigorously defines it, identifies any vulnerabilities associated with it and possibilities for mitigation of all vulnerabilities.

SPECIAL RESPONSIBILITIES

1. The ES&H Section is responsible for the development and implementation of the sitewide surveillance and monitoring program to audit Division/Section compliance with both internal and external discharge limits. They shall assist the FES Section in liaison functions with the POTWs.

2. Division/Sections are responsible for:

- for implementing this chapter (this includes consulting their Environmental Officer (EO) to provide advice on means and methods to remain in compliance with applicable standards and this chapter),
- knowledge of the infrastructure into which effluents from their areas are discharged,
- characterization of their waste streams (using sampling and analytical methods that conform to Standard Methods for the Examination of Water and Wastewater or an equivalent standard), and
- the maintenance of auditable records for all process under their control.

3. FESS is responsible for
   - maintaining documentation of sewer lines, connections, flows, and the condition of the collection system,
   - operating the ion regeneration process located in the Central Utility Building (CUB) and maintaining records needed to satisfy the terms of the pretreatment permit associated with this process,
   - approving the design of additions/modifications to the Fermilab sanitary sewer system, maintaining a liaison with POTW operators in Batavia and Warrenville.

PROGRAM DESCRIPTION

Two separate sanitary sewer systems serve Fermilab, one of which is connected to the Batavia publicly owned sanitary system, and one to the Warrenville system (see Figure 1 for contributions to the two systems).

The sanitary sewer system disposes of liquid process wastes to the maximum extent possible without exceeding regulatory limits for contaminants. This approach minimizes packaging and transportation costs of disposing of wastewater by other means.

Decisions on disposal of process wastewater should always be made using any and all potential measures to eliminate or minimize wastes at the process level, including re-using or recycling process chemicals where appropriate.

Prohibitions and discharge criteria set in this chapter have been chosen to meet concentration limits set by municipalities and our pre-treatment permit, prevent the introduction of any material into sanitary sewers that would interfere with the operation of POTWs, jeopardize equipment or compromise safety. Fermilab has developed discharge criteria to aid employees in making informed decisions about the release of wastewater onsite.

PROCEDURES

When new sewers or modifications to existing sanitary sewers are contemplated, the information form (Appendix B) must be completed and forwarded to FESS Engineering for review and approval prior to doing the work. No division/section, employee, or contractor shall establish, or permit to be established any connection between sewerage and potable water supplies. All modifications to sewers must be done by contractors licensed by the state of Illinois.

Discharge of wastewater into the sanitary sewers from processes at Fermilab should proceed only after careful analysis. Environmental Officers (EOs) from the division or section in which the discharge would originate should always be consulted prior to the discharge, to ensure that this chapter is being followed correctly. The general steps to be taken are as follows:

1. Determine if there are further steps that may be available to minimize or prevent the discharge from the process. This should be done as a formal Vulnerability Analysis. Possible steps include use of alternate chemicals that have less objectionable properties, using fewer chemicals, re-capturing discharge to re-use or recycle materials either here or off site.

2. Ensure that none of the Prohibitions (see Table 1) would be violated by the proposed discharge.

3. Verify that the process from which the discharge is planned is not a categorical process. The only way to assure that this step is completed is to compare the extensive list of categorical processes in the federal regulations with the process at Fermilab that is producing the discharge. This step should be done by the division/section EO in consultation with the ES&H Section.

4. Determine the characteristics of the wastewater to be disposed of, including:
   a. Volume (gallons)
   b. release rate (gallons per day)
   c. concentration of all regulated constituents (milligrams per liter)
   d. pH
   e. radiological constituents and activity (pico Curies per milliliter)

5. Calculate the daily pollutant load(s) for the appropriate sanitary sewerage system (i.e., either Batavia or Warrenville/Naperville). By applying the following formula (Note that 1 gallon = 3.784 liters):

   Concentration (mg/l) X Volume (l/day) = Load (mg)

   Ex: 164 mg/l of copper X (400 gal x 3.784 liters/gal)/day = 248,230 mg Cu
   (In this example we want to see if we can discharge daily a 400 gallon solution containing 164 mg/l of copper)

6. Compare the calculated load(s) with discharge criteria in Table 2. The load must be smaller than the factor in the table for the discharge to be allowable.

   Ex: In our example from above, the daily load from our Cu discharge, 248,230 mg is below the limit of 272,448 mg for the City of Batavia but above the limit of 227,040 mg for discharge to the City of Warrenville.

7. Effluents with a pH below 2.0 or above 12.5 are considered Hazardous Wastes under RCRA regulations and may not be discharged without further treatment (i.e., neutralization). If the pH of a potential discharge falls between 2.0 and 5.5, or between 9.0 and 12.5, and all other discharge criteria are met, the wastewater may be discharged to the sanitary sewer at a rate not to exceed 50 gallons per day. Effluents with pH from 5.5 to 9.0 can be released if all other discharge criteria are met.

8. Effluents potentially containing radionuclides can be discharged only if they comply with discharge limits specified in DOE Order 5400.5 (see Table 3).

Table 1

MATERIALS PROHIBITED FROM DISCHARGE INTO FERMILAB SEWERAGE

These requirements apply at the point where the process discharge enters the Fermilab sewerage system, i.e., at the point of generation. The following substances are **prohibited in any amount** from entering into the system:

1. Flammable and/or explosive materials,

2. Any RCRA hazardous waste,

3. Any solids or highly viscous substances (e.g., garbage, paper, cinders, sand, metal, rags, tar, wood, etc.),

4. Biocides (toxins or poisons) in a quantity sufficient to disrupt the sewage treatment process,

5. Storm water, surface water, ground water, roof runoff, subsurface drainage, cooling water or unpolluted process water,

6. Any other material that would cause any disruption to the wastewater treatment process, e.g., high chemical oxygen demand, high levels of oil and grease, high levels of suspended solids, etc.

7. Ethylene glycol. A 50% solution of propylene glycol may be released at a rate not to exceed 100 gallons per day.

Table 2

FERMILAB INTERNAL DISCHARGE LIMITS ON WASTEWATER SEWERAGE DISPOSAL (NON-RADIOLOGICAL CONSTITUENTS)

Pollutant	Batavia[1] Maximum Daily Pollutant Load in a Process Effluent (in mg)	Warrenville[2] Maximum Daily Pollutant Load in a Process Effluent (in mg)
As	68112	56760
Ba	681120	567600
Cd	40867	34056
Cr^{+3}	408672	340560
Cr^{+6}	81734	68112
Cu	272448	227040
CN^{-}	68112	56760
Fe	681120	567600
Pb	34056	28380
Mn	272448	227040
Hg	67	57
Ni	272448	227040
Phenols	81734	68112
Se	272448	227040
Ag	13622	11352
Zn	272448	227040
Propylene glycol	100 gal (50/50 mix)	NA

[1] Calculated using 36,000 gallons as the minimum daily Fermilab sewage volume to the City of Batavia sanitary system.

[2] Calculated using 30,000 gallons as the minimum daily Fermilab sewage volume to the Cities of Warrenville/Naperville sanitary system.

[The Maximum Daily Pollutant Load is calculated by using ½ of the mean daily flow to each of the municipal sanitary sewer systems from 2003 – 2005 as an estimate of the minimum flow. Implicit in this is the assumption that multiple process effluents would not be released simultaneously.]

Table 3

FERMILAB INTERNAL DISCHARGE LIMITS ON WASTEWATER SEWERAGE DISPOSAL (RADIOLOGICAL CONSTITUENTS)

[Note: This table indicates individual radionuclide limits; however, DOE 5400.5 requires additionally that the sum of the ratios of each radionuclide to the limit for that radionuclide be less than 1.0]

Radionuclide	Half-Life	Derived Concentration Guide Reference Value (pCi/ml)	Maximum Allowable Daily Concentration in a Process Effluent* (pCi/ml)*
^{3}H	12.3 years	2,000	10,000
^{7}Be	53.3 days	1,000	5000
^{22}Na	2.6 years	10	50
^{45}Ca	165 days	50	250
^{54}Mn	312 days	50	250
^{60}Co	5.27 years	5	25

*DOE Order 5400.5

Chapter 1, Part 7

DISCHARGES TO SANITARY SEWERAGE.

The control of releases of liquid wastes to community sanitary sewer systems is designed to be generally consistent with requirements imposed by NRC on its licensees. As discussed in Chapter II, the "best available technology" (BAT) selection process is to be applied to the treatment of liquid wastes released to sanitary sewerage when concentrations of radionuclides would otherwise exceed five times the Derived Concentration Guide (DCG) reference values given in Chapter III. Operators should ensure that the total annual discharge of radioactive material to the sanitary sewer system will not cause exposures to members of the general public that will result in doses exceeding a small fraction of the basic annual dose limit.

Chapter 2, Part 3d

DISCHARGES OF LIQUID WASTE TO SANITARY SEWERAGE.

The BAT selection process shall be implemented if liquid wastes discharged from DOE activities into sanitary sewerage contain radionuclides at concentrations, averaged monthly, would otherwise be greater than five times the DCG values for liquids given in Chapter III at the point of discharge. That is, the BAT selection process shall be implemented if the total of the fractions of the average concentrations for each radionuclide to its respective DCG value would otherwise exceed 5.

(1) Discharges to public sewers should be coordinated with the operators of the waste water treatment works.

(2) Concentrations shall be controlled so that long-term buildup of radionuclides in solids will not present a handling and disposal problem at sewage disposal plants.

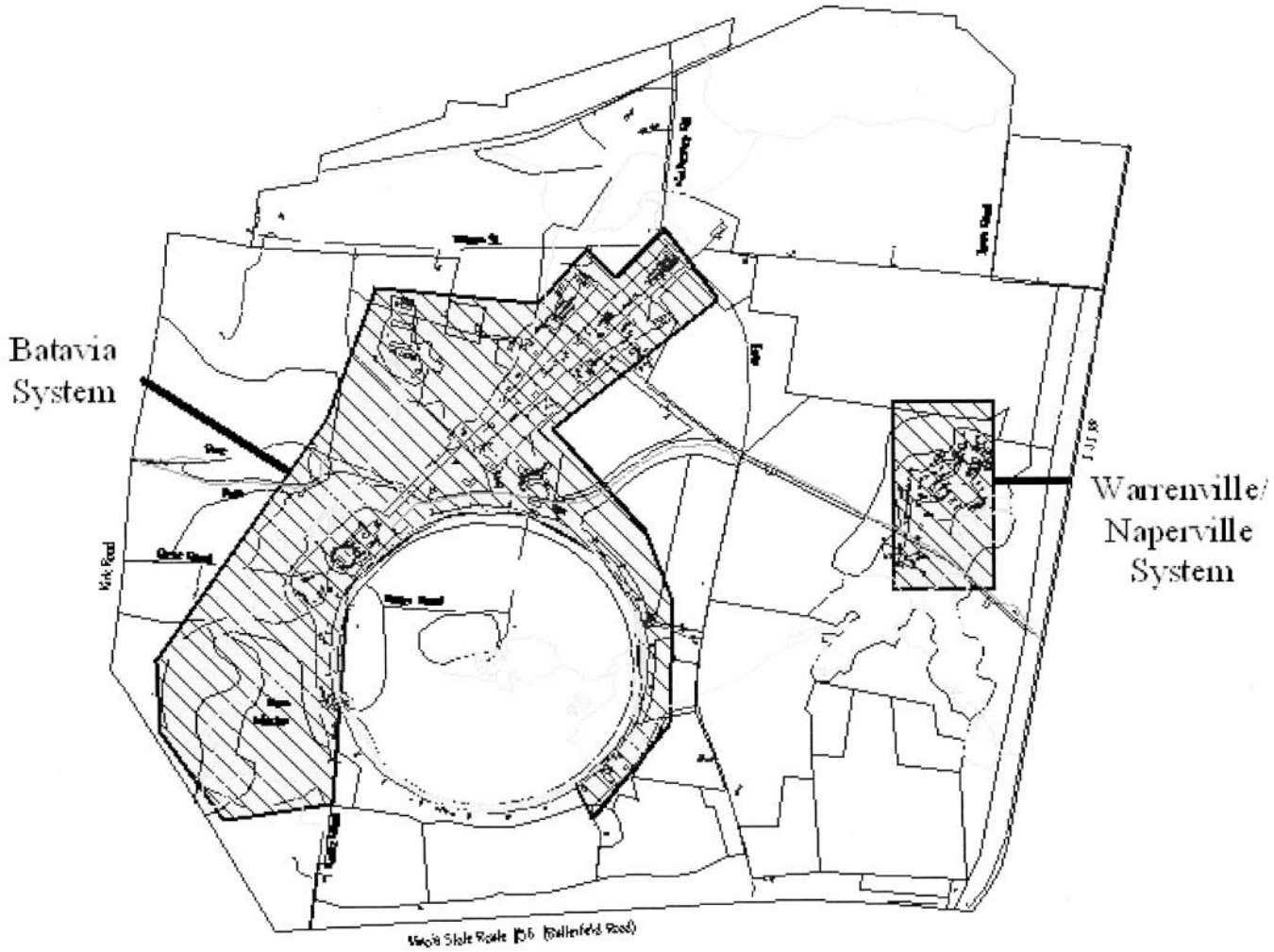
(3) Liquid wastes containing concentrations or quantities of radioactive materials that, when averaged monthly, are greater than those specified in paragraph II.3d may be discharged into a chemical or sanitary sewerage system (e.g., systems with drain fields excepted) if the system is owned by the Federal Government. However, ALARA process considerations are required. Such a sewerage system will provide liquid waste treatment prior to discharge to surface waters in accordance with the requirements of paragraph 11.3a(1).

(4) Operators should ensure that the total annual discharge of radioactive material to the sanitary sewer system will not cause exposures to members of the general public that will result in doses exceeding a small fraction of the basic annual dose limit.

Figure 1

FERMILAB SEWER SYSTEMS

Note: Sanitary sewerage within the shaded areas generally runs to the indicated municipal systems. It is the responsibility of Fermilab personnel to insure through their Division/Section Environmental Officer that the connection for each individual drain is known.[3]



[3] Refer to the Fermilab Drain Survey.

APPENDIX A

CITIES OF BATAVIA & WARRENVILLE/NAPERVILLE SANITARY SEWERAGE ORDINANCE DISCHARGE LIMITS

Applicable at point of discharge to public sewers (site boundary)[4]

Parameter	Maximum Concentration in mg/liter
Arsenic (total)	0.50
Barium (total	5.00
Cadmium (total)	0.30
Chromium (total trivalent)	3.00
Chromium (total hexavalent)	0.60
Copper (total)	2.00
Cyanide	0.50
Iron (total)	5.00
Lead (total)	0.25
Manganese (total)	2.00
Mercury (total)	0.0005
Nickel (total)	2.00
Phenols (total)	0.60
Selenium (total)	2.00
Silver (total)	0.10
Zinc (total)	2.00

[4] City of Batavia, City Code (Title 8, Ch. 3, Section 8-3-10-3).
City of Warrenville, City Code (Title 7, Ch. 4, Article D).

Appendix C

EXAMPLES OF INDUSTRIAL CATEGORIES SUBJECT TO NATIONAL CATEGORICAL PRETREATMENT STANDARDS[3]

Industry 40	CFR Section
Coil Coating	467
Electrical and electronic components manufacturing	469
Electroplating	413
Metal finishing	433
Photographic processing	459

OPERATIONS THAT ARE INCLUDED IN THE METAL FINISHING CATEGORY
(The six key metal-finishing operations are in boldface type)[4]

Electroplating	Vapor plating
Electroless plating	Sputtering
Thermal infusion	Salt Bath descaling
Solvent degreasing	Electrostatic painting
Paint stripping	Painting
Vacuum metallizing	Electropainting
Assembly	Calibration
Testing	Mechanical plating
Conversion coating	**Etching (chemical milling)**
Printed circuit board manufacturing	Cleaning

Machining	Grinding
Polishing	Barrel finishing (tumbling)
Burnishing	Impact deformation
Pressure deformation	Shearing
Heat treating	Thermal cutting
Welding	Brazing
Soldering	Flame spraying
Sand blasting	Other abrasive jet machining
Electronic discharge machining	Electrochemical machining
Electron beam machining	Laser beam machining
Plasma arc machining	Ultrasonic machining
Sintering	Laminating
Hot dip coating	Thermal infusion
Anodizing	

[1]Calculated using 25,000 gallons as the minimum daily Fermilab sewage volume to the City of Batavia sanitary system.
[2] Calculated using 40,000 gallons as the minimum daily Fermilab sewage volume to the Cities of Warrenville/Naperville system
[3]For federal regulations applicable to specific industries see 40 CFR Sections 405-471.
[4]Federal regulations state that if a facility conducts any of six key metal-finishing operations, discharges from those six and from the remaining 40 processes included in the category are covered by federal standards.