Wastewater 101

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Learning Objectives

- The history of wastewater
- Why we do what we do
- Types of wastewater treatment facilities
- How the treatment of wastewater happens
- How treatment systems are sized
- Governing bodies and reporting
- Understanding treatment plant reports

The History of Wastewater

- Prior to current systems – human waste discharged to nearby bodies of water – humans also consumed water from these nearby bodies – cholera, hepatitis, dysentery
- "The solution to pollution is dilution" – yes and no
- Late 19th and early 20th century – treatment plants began
- 1900's – sewage-collection systems to separate storm water from domestic wastewater
- Mid 20th century – regulation developed for growing concern for the environment
- 1948 – The Federal Water Pollution Control Act
- 1972 – The Clean Water Act

Why we do what we do

- Clean Water Act
- Protect the users of receiving waters – decrease pollution/human contamination
  - Surface waters
  - Ground water
- Pollution definition: “any interference with the beneficial reuse of water or failure to meet water quality requirements”
- Inadequately treated wastewater can transfer diseases such as dysentery, hepatitis, and typhoid fever to animals and humans.
- Failing systems also leak excessive nutrients and bacteria to rivers, lakes, and the ocean, destroying plant and animal habitat, closing beaches, and hurting the fishing industry.

Types of wastewater treatment facilities

- Combined Systems
- Separate Systems
  - MBR – latest and greatest
  - RBC – standing the test of time
  - Larger scale Bioclere or Amphidrome
  - Conventional extended aeration
- Alternative Systems – title V systems
  - Bioclere
  - FAST
  - Amphidrome
  - Conventional (Traditional) Septic Systems

How WWTFs differ from traditional septic systems

- Traditional system
  - septic tank
  - distribution box
  - soil absorption system (SAS) (leach field)
- Innovative/Alternative (I/A) on-site systems have several advantages:
  - Remove solids and other pollutants from wastewater before it goes to the soil absorption system (SAS).
  - The SAS following an I/A technology can be expected to have a longer life.
  - Advanced treatment options (reduction of nitrogen content).
  - Sometimes required for new construction, including additions to existing homes, near a private or public water supply well or other nitrogen-sensitive areas.

How treatment systems are sized

- “The size and capacity of wastewater treatment systems are determined by the estimated volume of sewage generated from residences, businesses, and industries connected to sewer systems as well as the anticipated inflows and infiltration (I&I)”.
- Often determined by the builder/engineer designing the site with approval from local governing agencies and sometimes the DEP
- 110 gal/day/bedroom

How the treatment of wastewater happens

- There are 3 levels of WW treatment: primary, secondary, and tertiary (or advanced).
  - Primary treatment
    - removes 60+ % TSS, 35+ % BOD
    - dissolved impurities are not removed
    - Usually first step
  - Secondary treatment
    - removes 85+ % TSS and BOD
    - minimum level of secondary treatment required in USA and other developed countries
    - When more TSS and BOD must be removed, or when dissolved nitrate and phosphate levels must be reduced, tertiary treatment methods are used
  - Tertiary processes
    - 99+ % of all impurities from sewage, producing an effluent of almost drinking-water quality
    - the last step prior to discharge into a body of surface water is disinfection, which destroys any remaining pathogens in the effluent and protects public health

WWTF System Components

- Primary Settling Tanks
- FET
- Anoxic Tank
- Aerobic Tank
- Filtration/Clarification
- Disinfection
- Dosing to SAS or Surface Water

Important Monitored Parameters

- Determined by
  - I/A Title V Approval Letters
  - GWD (Ground Water Discharge) Permit
  - NPDES permit from the EPA
  - Board of Health mandate
- BOD - biological oxygen demand
  - an indicator of the amount of organic material in sewage that is likely to decay.
  - “The more organic material there is in the sewage, the higher the BOD, which is the amount of oxygen required by microorganisms to decompose the organic substances in sewage”.
- TSS – total suspended solids
  - the volume of sludge produced in a treatment plant is directly related to the total suspended solids present in the sewage
  - the extent to which a treatment plant removes suspended solids = efficiency of treatment process
- Nitrogen and Phosphorus – plant nutrients
- Microbes (fecal coliform)
- pH

Governing bodies and types of reporting

- Governing bodies
  - Federal - EPA
  - State – MassDEP
  - City/Town – Board of Health
- Reporting
  - WWTF discharging 10,000+ gpd
  - I/A Title V Systems
  - Sewerage “spills”

Understanding wastewater reports

- DMR (Discharge Monitoring Report)
- Title V Reports (DEP Approved Inspection and O&M Form for Title 5 I/A Treatment and Disposal Systems)
  - This is different than a commonly known “Title V Inspection”
- SSO/CSO (Sanitary Sewer Overflow/Combined Sewer Overflow)

DMR

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Groundwater Discharge Program
Groundwater Permit
DAILY LOG SHEET

1. Permit Number:
2. Tax Identification Number: [redacted]
3. Sampling Month & Frequency: 2020 JUN DAILY

C. Daily Readings/Analysis Information

Date	Effluent Flow GPD	Reuse Flow GPD	Irrigation Flow GPD	Turbidity	Influent pH	Effluent pH	Chlorine Residual (mg/l)	UV Intensity (%)
1	ND				4.67	7.79		
2	ND				4.86	7.64		
3	4208				4.86	7.80		
4	ND				4.86	7.53		
5	6548				4.89	7.65		
6	4391							
7	NS							
8	ND				4.60	7.72		
9	5099				4.91	7.86		
10	3402				4.92	8.04		
11	3677				4.79	7.66		
12	5490				5.00	7.63		
13	7293							
14	4753							
15	1700				6.68	7.46		
16	825				6.75	8.01		
17	6284				6.14	7.44		
18	4498				5.28	7.59		
19	3976				5.93	7.92		
20	7456							
21	4777							
22	2834				6.89	7.69		
23	5343				6.78	7.73		
24	7071				5.65	7.65		
25	3540				5.46	7.76		
26	4502				5.61	7.47		
27	5311							
28	5529							
29	6415				6.96	7.62		
30	6837				5.70	7.86		
31								

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Groundwater Discharge Program
Groundwater Permit
DISCHARGE MONITORING REPORT

1. Permit Number:
2. Tax Identification Number: [redacted]
3. Sampling Month & Frequency: 2020 JUN MONTHLY

D. Contaminant Analysis Information

- For "0", below detection limit, less than (<) value, or not detected, enter "ND"
- TNTC = too numerous to count. (Fecal results only)
- NS = Not Sampled

1. Parameter/Contaminant / Units	2. Influent	3. Effluent	4. Effluent Method Detection limit
BOD MGL	1310	ND	2
TSS MGL	617	ND	1
TOTAL SOLIDS MGL	1600		
AMMONIA-N MGL	10.8		
NITRATE-N MGL		1.63	0.25
TOTAL NITROGEN(NO3+NO2+TKN) MGL		1.93	
OIL & GREASE MGL		ND	2.11
FOAMING AGENTS (MBAS) MGL		ND	0.025

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Groundwater Discharge Program
Groundwater Permit
MONITORING WELL DATA REPORT

1. Permit Number:
2. Tax Identification Number: [redacted]
3. Sampling Month & Frequency: 2020 JUN MONTHLY

C. Contaminant Analysis Information

- For "0", below detection limit, less than (<) value, or not detected, enter "ND"
- TNTC = too numerous to count. (Fecal results only)
- NS = Not Sampled
- DRY = Not enough water in well to sample.

Parameter/Contaminant / Units	MW-A Well #: 1	MW-B Well #: 2	MW-C Well #: 3	Well #: 4	Well #: 5	Well #: 6
PH S.U.	DRY	6.22	6.78			
STATIC WATER LEVEL FEET	DRY	6.3	3.7			
SPECIFIC CONDUCTANCE UMHOS/C	DRY	647	938			

Title V Report

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Title 5
DEP Approved Inspection and O&M Form for Title 5 I/A Treatment and Disposal Systems

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

A. Installation

Owner

Facility Street Address

City | Zip

Mailing address of owner, if different:

Street Address/PO Box:

City | State | Zip

( ) - ext.
Telephone Number

B. Authorized Service Provider

O&M Firm

Street Address

City | State | Zip

( ) - ext.
Telephone Number

Certified Operator Name | Certification Number

C. Facility/System Information

DEP ID | Manufacturer ID | Model Number

Installation Date | Start of Operation

Approval Type: ☐ General ☐ Provisional ☐ Piloting ☐ Remedial

Seasonal Residence – used less than 6 mo./year: ☐ Yes ☐ No

D. Operating Information

Inspection Date | Previous Inspection Date

Sludge Depth (to be checked yearly) | Pumping Recommended ☐ Yes ☐ No

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Title 5
DEP Approved Inspection and O&M Form for Title 5 I/A Treatment and Disposal Systems

E. Field Testing

Field Inspection:

Color: ☐ gray ☐ brown ☐ clear ☐ turbid
☐ Other (specify):

Odor: ☐ musty ☐ earthy ☐ moldy ☐ offensive ☐ turbid

Effluent Solids: ☐ no ☐ some

pH ___ SU (6 to 9) DO ___ mg/L (2 or greater) Turbidity ___ NTU (40 or less)

Should a Remedial or General Use system fail the Field Testing, effluent samples shall be collected per Standard Methods and analyzed for BOD and TSS.

F. Sampling Information

Samples Taken: ☐ Influent ☐ Effluent

Commercial systems or systems with a design flow of 2000 gpd and greater, and General Use nitrogen reducing systems:

gpd

Parameters sampled: ☐ pH ☐ BOD ☐ CBOD ☐ TSS ☐ TN ☐ Other (list below)

Other 1 | Other 2 | Other 3

G. Inspection and Maintenance

Description of any maintenance performed since previous inspection & during this inspection:

Notes and Comments:

Massachusetts Department of Environmental Protection
Bureau of Resource Protection - Title 5
DEP Approved Inspection and O&M Form for Title 5 I/A Treatment and Disposal Systems

H. Certification

I certify: I have inspected the sewage treatment and disposal system at the address above, have conducted the required Field Testing and/or sample collection in accordance with Standard Methods, have completed this report and the attached technology operation and maintenance checklist, and the information reported is true, accurate, and complete as of the time of the inspection. I am a Massachusetts certified operator in accordance with 257 CMR 2.00.

Operator Signature | Date

System owner must submit this report, technology O&M checklist, and any required sampling results to the local board of health as follows for each inspection performed:

Remedial Use – by January 31st of each year for the previous calendar year

Piloting Use - within 45 days of inspection date

Provisional Use – by March 31th of each year for the previous 12 months

General Use – by September 30th of each year for the previous 12 months

Send to:
Department of Environmental Protection
Attention: Title 5 Program
One Winter Street, 5th Floor
Boston, MA 02108

SSO

Massachusetts Department of Environmental Protection
Bureau of Water Protection – Wastewater Management Program
Sanitary Sewer Overflow (SSO)/Bypass Notification Form

FOR DEP USE ONLY

Tax Identification Number

A. Reporting Facility

Important: When filling out forms on the computer, use only the tab key to move your cursor - do not use the return key.

1. Facility Information

Reporting Sewer Authority _____ Permit # _____

2. Authorized Representative Transmitting Form:

First Name _____ Last Name _____ Telephone No. _____

Title _____ E-mail Address _____

B. Phone Notifications:

See DEP Regional Office telephone and fax numbers at the end of this form.

1. **MassDEP staff** contacted: first name _____ last name _____

Date/Time contacted: Date _____ Time _____ ☐ am ☐ pm

2. **EPA staff** contacted: first name _____ last name _____

Date/Time EPA contacted: Date _____ Time _____ ☐ am ☐ pm

3. Board of Health contacted: First Name _____ Last Name _____

Date/Time contacted: Date _____ Time _____ ☐ am ☐ pm

4. Others notified (select all that apply); ☐ Conservation Commission

☐ Harbormaster ☐ Shellfish Warden ☐ Division of Marine Fisheries

☐ Downstream Drinking Water Supplier ☐ Watershed Association

☐ Beach Resource Manager ☐ Other: _____ (specify)

C. SSO Information

1. SSO Discovered: Date _____ Time _____ ☐ am ☐ pm

By: _____

2. SSO Stopped: Date _____ Time _____ ☐ am ☐ pm

3. SSO Discharge from: ☐ Sanitary Sewer Manhole ☐ Pump Station

☐ Backup into Property ☐ Other: _____ (specify)

4. SSO Discharge to: ☐ Ground Surface (no release to surface water)

☐ Direct to Receiving Water _____ (surface water)

☐ Catch basin to Receiving Water _____ (surface water)

☐ Backup into Property Basement

Massachusetts Department of Environmental Protection
Bureau of Water Protection – Wastewater Management Program
Sanitary Sewer Overflow (SSO)/Bypass Notification Form

FOR DEP USE O

Tax Identification Nur

C. SSO Information (cont.)

Location: _____ (Description of discharge site or closest address)

5. Estimated SSO Volume at time of this Report: _____

Method of Estimating Volume: _____

6. Cause of SSO Event:

☐ Rain Event ☐ Pump Station Failure ☐ Insufficient Capacity in System

☐ Treatment Unit failure

☐ Sewer System Blockage: ☐ Pipe Collapse ☐ Root Intrusion ☐ Grease Blockage

☐ Other: _____ (Specify)

7. Corrective Actions Taken:

_____

_____

_____

_____

Impact Area cleaned and/or disinfected: ☐ Yes ☐ No

_____

_____

Corrective Actions Completed: ☐ Yes ☐ No

_____

D. Comments/Attachments/Follow-up

I wish to provide (select all that apply):

☐ Attachment ☐ Additional comments below: ☐ No additional comments or attachments

Additional comments and planned actions:

_____

_____

_____

Massachusetts Department of Environmental Protection
Bureau of Water Protection – Wastewater Management Program
Sanitary Sewer Overflow (SSO)/Bypass Notification Form

FOR DEP USE ONLY

Tax Identification Number

E. Certification Statement

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Signature of Authorized Representative _____ Date Signed _____

Please keep a copy of this report for your records. When submitting additional information, include the MassDEP Incident Number from this report.

MassDEP Regional Office and EPA Telephone and Fax Numbers:

Northeast Region	Phone: 978-694-3215	Fax: 978-694-3499
Southeast Region	Phone: 508-946-2750	Fax: 508-947-6557
Central Region	Phone: 508-792-7650	Fax: 508-792-7621
Western Region	Phone: 413-784-1100	Fax: 413-784-1149
EPA	Phone: 617-918-1510	
EPA for Southeast Region, David Turin	Phone: 617-918-1598	Fax: 617-918-0598
EPA for Northeast, Central and Western Regions, Douglas Koopman	Phone: 617-918-1747	Fax: 617-918-0747
DEP 24-hour emergency	Phone: 888-304-1133	

Resources

- https://www.mass.gov/orgs/massachusetts-department-of-environmental-protection
- https://www.britannica.com/technology/wastewater-treatment
- https://www.epa.gov/eg
- https://www.epa.gov/laws-regulations/history-clean-water-act