PRETREATMENT 202

CONTINUING EDUCATION
PROFESSIONAL DEVELOPMENT COURSE

Technical Learning College

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PRETREATMENT

The term **"pretreatment"** means the treatment of wastewater by commercial and industrial facilities to remove harmful pollutants before being discharged to a sewer system under the control of a publicly owned treatment works (POTWs). "Pretreatment" is also defined in **Title 40 Code of Federal Regulations (40 CFR) Subsection 403.**

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Responsibility

This course contains EPA's federal rule requirements. Please be aware that each state implements wastewater/pretreatment/safety regulations that may be more stringent than EPA's or OSHA's regulations. Check with your state environmental agency for more information. You are solely responsible in ensuring that you abide with your jurisdiction or agency's rules and regulations.

Important Information about this Manual

This training manual has been prepared to help students gain or increase awareness of the Environmental Protection Agency's Rules and Regulation relating to Title 40 Code of Federal Regulations, Part 403, "*General Pretreatment Regulations for Existing and New Sources of Pollution*," and other applicable State and Federal laws, including but not limited to, the Clean Water Act, Industrial pretreatment 40 CFR. This course will cover the fundamentals and basic requirements of the federal rule concerning the national pretreatment rule, permitting, POTW requirements, local limits, wastewater sampling requirements and reporting information.

The scope of the material is quite large, requiring a major effort to bring it under control. Employee health and safety, as well as that of the public, depends upon careful application of federal and state regulations and safe working procedures.

This training manual will cover federal laws, regulations, required procedures and work rules relating to general pretreatment and wastewater sampling. It should be noted, however, that the federal and state regulations are an ongoing process and subject to change over time. For this reason, a list of resources is provided to assist in obtaining the most up-to-date information on various subjects and regulations

This manual is an educational document for employees and operators who are involved with water quality and pollution control. It is not designed to meet the full requirements of the United States Environmental Protection Agency (EPA) or the Department of Labor-Occupational Safety and Health Administration (OSHA), or your State pretreatment rules and regulations.

This course manual will provide general guidance and should not be used as a basis for developing general pretreatment, enforcement, reporting or wastewater sampling rules/plans. This document is not a detailed pretreatment, pollution control, pollution prevention, wastewater treatment textbook or a comprehensive source book on water/wastewater rules and regulations.

Technical Learning College or Technical Learning Consultants, Inc. makes no warranty, guarantee or representation as to the absolute correctness or appropriateness of the information in this manual and assumes no responsibility in connection with the implementation of this information. It cannot be assumed that this manual contains all measures and concepts required for specific conditions or circumstances.

This training manual should be used for education and is not considered a legal document. Individuals who are responsible for pretreatment programs and/or water/wastewater sampling and the health and safety of workers at hazardous waste sites should obtain and comply with the most recent federal, state, and local regulations relevant to these sites and are urged to consult with OSHA, the EPA and other appropriate federal, state and local agencies.

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Technical Learning College's Scope and Function

Welcome to the Program,

Technical Learning College (TLC) offers affordable continuing education for today's working professionals who need to maintain licenses or certifications. TLC holds several different governmental agency approvals for granting of continuing education credit.

TLC's delivery method of continuing education can include traditional types of classroom lectures and distance-based courses or independent study. TLC's distance based or independent study courses are offered in a print - based distance educational format. We will beat any other training competitor's price for the same CEU material or classroom training.

Our courses are designed to be flexible and for you to finish the material at your convenience. Students can also receive course materials through the mail. The CEU course or e-manual will contain all your lessons, activities and instruction to obtain the assignments. All of TLC's CEU courses allow students to submit assignments using e-mail or fax, or by postal mail. (See the course description for more information.)

Students have direct contact with their instructor—primarily by e-mail or telephone. TLC's CEU courses may use such technologies as the World Wide Web, e-mail, CD-ROMs, videotapes and hard copies. (See the course description.) Make sure you have access to the necessary equipment before enrolling; i.e., printer, Microsoft Word and/or Adobe Acrobat Reader. Some courses may require proctored closed-book exams, depending upon your state or employer requirements.

Flexible Learning
At TLC, there are no scheduled online sessions or passwords you need contend with, nor are you required to participate in learning teams or groups designed for the "typical" younger campus based student. You will work at your own pace, completing assignments in time frames that work best for you. TLC's method of flexible individualized instruction is designed to provide each student the guidance and support needed for successful course completion.

Course Structure
TLC's online courses combine the best of online delivery and traditional university textbooks. You can easily find the course syllabus, course content, assignments, and the post-exam (Assignment). This student-friendly course design allows you the most flexibility in choosing when and where you will study.

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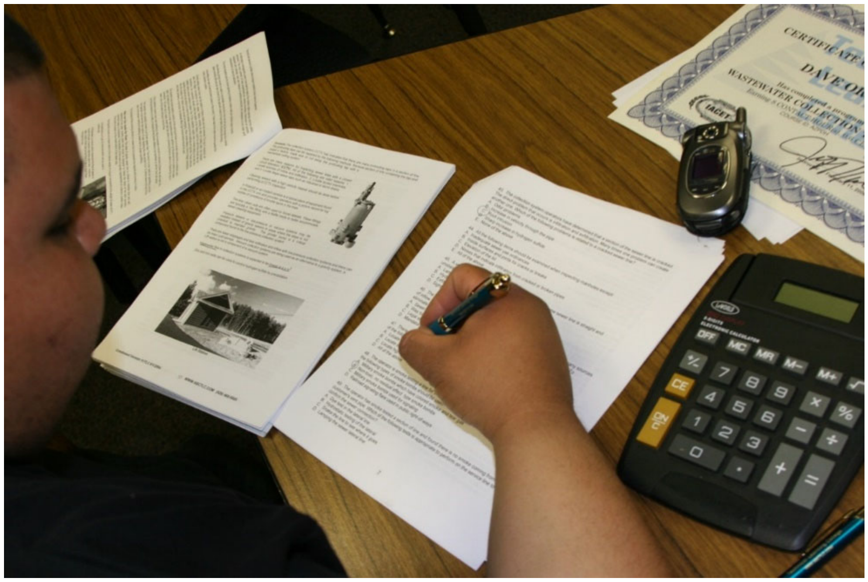
TLC offers you the best of both worlds. You learn on your own terms, on your own time, but you are never on your own. Once enrolled, you will be assigned a personal Student Service Representative who works with you on an individualized basis throughout your program of study. Course specific faculty members (S.M.E.) are assigned at the beginning of each course providing the academic support you need to successfully complete each course. Please call or email us for assistance.

Satisfaction Guaranteed
We have many years of experience, dealing with thousands of students. We assure you, our customer satisfaction is second to none. This is one reason we have taught more than 20,000 students.



We welcome you to do the electronic version of the assignment and submit the answer key and registration to us by either fax or e-mail. If you need this assignment graded and a certificate of completion within a 48-hour turn around, prepare to pay an additional rush charge of $50.

Contact Numbers

Fax (928) 468-0675
Email Info@tlch2o.com
Telephone (866) 557-1746

CEU Course Description

PRETREATMENT 202 CEU TRAINING COURSE

Purpose
The Industrial Pretreatment program is a federally mandated program under the Clean Water Act, which controls the discharges of commercial and industrial facilities. The purpose of the pretreatment program is to block the introduction of pollutants, which can cause damage to equipment and interference with the wastewater treatment process, into the wastewater collection and transmission system. The program is important in preventing harm to workers, the public and the environment.

Course Focus
The NPDES program requires that all point source discharges to waters of the U.S. (i.e., *"direct discharges*") must be permitted. To address *"indirect discharges*" from industries to Publicly Owned Treatment Works (POTWs), the EPA, through CWA authorities, established the National Pretreatment Program as a component of the NPDES Permitting Program. The National Pretreatment Program requires industrial and commercial dischargers to treat or control pollutants in their wastewater prior to discharge to POTWs.

Course Reference
This training manual provides documentation of EPA's recommendations as well as federal requirements for Significant Industrial User (SIU) permit contents and structure. The manual contains many examples of sections and conditions of a permit, as well as complete sample permits and fact sheets. The goal is to furnish this information to operators in a reference manual format that they can use throughout the permitting process or as a pretreatment reference. For such individuals, the training manual provides background information on requirements of the pretreatment program/permitting and discusses the necessary legal authority required to implement an effective program.

It is recommended that all operators who are directly involved with the permit drafting and issuance processes understand the entire manual to get an overview of its contents and structure. The pretreatment/industrial waste and wastewater treatment field is quite vast and is a difficult subject to grasp.

Technical Learning College has copied most of this course information from the U.S. Environmental Protection Agency (EPA), Office of Water, guidance manual **Industrial User Permitting Guidance Manual 833-R-12-001A September 2012***.*

TLC will use this information guidance for you to understand the mechanisms and need for developing and issuing permits (or control mechanisms) to nondomestic (Industrial) Users under the National Pretreatment Program. The purpose of this training manual is to provide continuing education to wastewater and pretreatment operators and administrative personnel who are involved in implementing an SIU permitting program in preparing effective and enforceable permits or other control mechanisms.

The intent of this training course, *Pretreatment 202*, is to:
(1) Provide a reference for anyone interested in understanding the basics of the pretreatment program requirements, *and*
(2) Provide a roadmap to additional and more detailed guidance materials for those trying to implement specific elements of the Pretreatment Program.

This course is intended to provide an understanding of the basic concepts of the Pretreatment Program and CWA requirements and related concerns for all those involved with implementing or working within the Pretreatment Program.

Intended Audience
Stormwater Inspectors, Wastewater Treatment Operators, Pretreatment and Industrial Waste Inspectors--the target audience for this course is the person interested in working in the stormwater/pretreatment field. This course was designed for the pretreatment inspector or for the wastewater treatment/wastewater collection operator who performs various pretreatment related job duties. This course is also for operators wishing to maintain CEUs for certification license, wanting to learn how to do the job safely and effectively, and/or to meet education needs for promotion. This CEU Course will review the Environmental Protection Agency's Rules and Regulation relating to Title 40 Code of Federal Regulations, Part 403, "*General Pretreatment Regulations for Existing and New Sources of Pollution*," and other applicable State and Federal laws, including but not limited to, the Clean Water Act and the Industrial Pretreatment 40 CFR. This course will cover the fundamentals and basic requirements of the Federal rule concerning the National Pretreatment Rule, POTW, wastewater sampling and reporting information.

Final Examination for Credit
Opportunity to pass the final comprehensive examination is limited to three attempts per course enrollment.

Course Procedures for Registration and Support
All of Technical Learning College's distance learning courses have complete registration and support services offered. Delivery of services will include, e-mail, web site, telephone, fax and mail support. TLC will attempt immediate and prompt service.

When a student registers for a distance or correspondence course, he/she is assigned a start date and an end date. It is the student's responsibility to note dates for assignments and keep up with the course work. If a student falls behind, he/she must contact TLC and request an end date extension in order to complete the course. It is the prerogative of TLC to decide whether to grant the request. All students are tracked by a unique number assigned to each student.

Instructions for Written Assignments
The Pretreatment 202 CEU Training course uses a multiple-choice style answer key.

Feedback Mechanism (Examination Procedures)
Each student will receive a feedback form as part of his or her study packet. You will find this form in the rear of the course or lesson.

Security and Integrity
All students are required to do their own work. All lesson sheets and final exams are not returned to the student to discourage sharing of answers. Any fraud or deceit and the student will forfeit all fees and the appropriate agency will be notified.

Grading Criteria
TLC will offer the student either pass/fail or a standard letter grading assignment. If TLC is not notified, you will only receive a pass/fail notice.

Required Texts
The Pretreatment 202 CEU Training course comes complete with the Environmental Protection Agency's Rules and Regulation relating to Title 40 Code of Federal Regulations, Part 403, "General Pretreatment Regulations for Existing and New Sources of Pollution," and other applicable State and Federal laws, including but not limited to, the Clean Water Act and Industrial Pretreatment 40 CFR.

There are two glossaries, one large one in the rear of this course and a detailed EPA compliance term in the front and a list of acronyms and abbreviations immediately following this section are provided to assist the reader. When terms appear that are unfamiliar, the reader should consult the glossary and list of acronyms and abbreviations.

Recordkeeping and Reporting Practices
TLC will keep all student records for a minimum of seven years. It is the student's responsibility to give the completion certificate and any other forms to the appropriate agencies. TLC will not release any records to any other party.

ADA Compliance
TLC will make reasonable accommodations for persons with documented disabilities. Students should notify TLC and their instructors of any special needs. Course content may vary from this outline to meet the needs of this particular group.

Mission Statement
Our only product is educational service. Our goal is to provide you with the best possible education service possible. TLC will attempt to make your learning experience an enjoyable opportunity.

Educational Mission
The educational mission of TLC is:
To provide TLC students with comprehensive and ongoing training in the theory and skills needed for the environmental education field,

To provide TLC students with opportunities to apply and understand the theory and skills needed for operator certification,

To provide opportunities for TLC students to learn and practice environmental educational skills with members of the community for the purpose of sharing diverse perspectives and experience,

To provide a forum in which students can exchange experiences and ideas related to environmental education,

To provide a forum for the collection and dissemination of current information related to environmental education, and to maintain an environment that nurtures academic and personal growth.

Course Limitations

While this training manual gives an overview of the pretreatment requirements, it is not intended to address all the specific questions that could arise during the permitting process. Where other pertinent guidance is available, this manual references those documents. The permit writer is, therefore, encouraged to use this manual in conjunction with the following EPA guidance documents:

- *Local Limits Development Guidance*
- *Guidance for Developing Control Authority Enforcement Response Plans*
- *Guidance Manual for the Control of Wastes Hauled to Publicly Owned Treatment Works*
- *Industrial User Inspection and Sampling Manual for POTWs*
- *Multijurisdictional Pretreatment Programs Guidance Manual*
- *Pretreatment Streamlining Rule Fact Sheet 7.0: Best Management Practices* (EPA-833-F-06-013)

Those documents serve as companion documents to this manual and contain technical guidance on developing local limits, specific information on enforcing Pretreatment Standards and Requirements, guidance for controlling hauled waste, information regarding compliance inspections and sampling, guidance on implementing a pretreatment program within multiple jurisdictions, and information regarding best management practices.

Throughout the text of this manual, all references to supplementary guidance material and development documents cite only the document title. Complete citations for all relevant guidance documents are found in the bibliography in Appendix A. Any reference to the *Code of Federal Regulations* (CFR) is followed by a bracketed citation of the specific section (e.g., [40 CFR Part 403]). References to the *Federal Register* are also bracketed (e.g., [53 FR Part 40562; October 17, 1988]).

In general, each Control Authority has pretreatment concerns unique to its own area, necessitating specific local requirements. Discussion of specific requirements that must be met to comply with local or state laws under which a Control Authority operates is beyond the scope of this document. The permit writer or operator should, therefore, consult with his/her attorney on such issues.

The National Pretreatment Program continues to evolve, and the concepts and procedures recommended here could change with time and experience. For notifications on updates to the National Pretreatment Program, see EPA's website (www.epa.gov/npdes/pretreatment).

At the End of this Course....
The student will be able to understand and describe the basic requirements of the federal rule concerning pretreatment/industrial/commercial requirements, POTW requirements, SIU responsibilities, permitting, wastewater sampling (local limits) and reporting information.

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Preface *(Credit USEPA)*

The industrial boom in the United States during the 1950s and 60s brought with it a level of pollution never before seen in this country. Scenes of dying fish, burning rivers, and thick black smog engulfing major metropolitan areas were images and stories repeated regularly on the evening news. In December of 1970, the President of the United States created the U.S. Environmental Protection Agency (EPA) through an executive order in response to these critical environmental problems.

PRETREATMENT OBJECTIVES

The **Pretreatment Program** is to control the pollutants discharged into sewer systems and to **reduce the amount of pollutants released into the environment**. Most POTWs are designed to treat sanitary (domestic) wastes from households, but not to treat toxic pollutants from industrial or commercial facilities. The toxic pollutants from industrial and commercial facilities may cause serious problems at POTWs. These problems may be prevented by recycling, waste minimization, chemical substitution, pretreatment, or other best management practices to reduce or eliminate the pollutants from commercial or industrial facilities.

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In 1972, Congress passed the Clean Water Act (CWA) to restore and maintain the integrity of the nation's waters. Although prior legislation had been enacted to address water pollution, those previous efforts were developed with other goals in mind. For example, the 1899 Rivers and Harbors Act protected navigational interests while the 1948 Water Pollution Control Act and the 1956 Federal Water Pollution Control Act merely provided limited funding for State and local governments to address water pollution concerns on their own.

The CWA required the elimination of the discharge of pollutants into the nation's waters and the achievement of fishable and swimmable water quality levels. The EPA's National Pollutant Discharge Elimination System (NPDES) Permitting Program represents one of the key components established to accomplish this feat.

The NPDES program requires that all point source discharges to waters of the U.S. (i.e., *"direct discharges*") must be permitted. To address *"indirect discharges*" from industries to Publicly Owned Treatment Works (POTWs), the EPA, through CWA authorities, established the National Pretreatment Program as a component of the NPDES Permitting Program. The National Pretreatment Program requires industrial and commercial dischargers to treat or control pollutants in their wastewater prior to discharge to POTWs.

In 1986, more than one-third of all toxic pollutants entered the nation's waters from publicly owned treatment works (POTWs) through industrial discharges to public sewers. Certain industrial discharges, such as slug loads, can interfere with the operation of POTWs, leading to the discharge of untreated or inadequately treated wastewater into rivers, lakes, etc. Some pollutants are not compatible with biological wastewater treatment at POTWs and may pass through the treatment plant untreated.

This “pass through” of pollutants impacts the surrounding environment, occasionally causing fish kills or other detrimental alterations of the receiving waters. Even when POTWs have the capability to remove toxic pollutants from wastewater, these toxins can end up in the POTW’s sewage sludge, which in many places is land applied to food crops, parks, or golf courses as fertilizer or soil conditioner.

The National Pretreatment Program is unique in that the General Pretreatment Regulations require all large POTWs (i.e., those designed to treat flows of more than 5 million gallons per day) and smaller POTWs with significant industrial discharges to establish local pretreatment programs.

These local programs must enforce all national pretreatment standards and requirements in addition to any more stringent local requirements necessary to protect site-specific conditions at the POTW. More than 2,300 POTWs have developed and are implementing local pretreatment programs designed to control discharges from approximately 23,000 significant industrial users.

Since 1983, the Pretreatment Program has made great strides in reducing the discharge of toxic pollutants to sewer systems and to waters of the U.S. In the eyes of many, the Pretreatment Program, implemented as a partnership between the EPA, States, and POTWs, is a notable success story in reducing impacts to human health and the environment. These strides can be attributed to the efforts of many Federal, State, local, and industrial representatives who have been involved with developing and implementing the various aspects of the Pretreatment Program.

The EPA has supported the Pretreatment Program through development of numerous guidance manuals. The EPA has released more than 30 manuals that provide guidance to the EPA, States, POTWs, and industry on various pretreatment program requirements and policy determinations.

Through the EPA’s guidance, the Pretreatment Program has maintained national consistency in interpretation of the regulations. Nevertheless, turnover in pretreatment program staff has diluted historical knowledge, leaving new staff and other interested parties unaware of existing materials.

NPDES Permit Foreword

Once a wastewater plant is designed and built, state or federal agencies will determine the type of permit required using the information illustrated above. You will need to understand that this discharge permit is your legal standard for proper sampling, treatment and discharging.

You must abide by your permit requirements and not deviate from them based on information presented in this course.

List of Pretreatment Acronyms

Acronym	Full Phrase
AA	Approval Authority
AO	Administrative Order
BAT	Best Available Technology Economically Achievable
BCT	Best Conventional Pollutant Control Technology
BMP	Best Management Practices
BMR	Baseline Monitoring Report
BOD5	5-day Biochemical Oxygen Demand Test
BPJ	Best Professional Judgment
BPT	Best Practicable Control Technology Currently Available
CA	Control Authority
CFR	Code of Federal Regulations
CIU	Categorical Industrial User
CSO	Combined Sewer Overflow
CWA	Clean Water Act (formerly referred to as the Federal Water Pollution Control Act or Federal Water Pollution Control Act Amendments of 1972) Pub. L. 92-500, as amended by Pub. L. 95-217, Pub. L. 95-576, Pub. L. 96-483, Pub. L. 97-117, and Pub. L. 100-4, 33 U.S.C. 1251 et seq.
CWF	Combined Wastestream Formula
CWT	Centralized Waste Treater
DMR	Discharge Monitoring Report
DSE	Domestic Sewage Exclusion
DSS	Domestic Sewage Study
ELG	Effluent Limitations Guideline
EPA	Environmental Protection Agency
EPCRA	Emergency Preparedness and Community Right to Know Act
ERP	Enforcement Response Plan
FOG	Fats, Oils and Grease
FDF	Fundamentally Different Factors
FR	Federal Register

FWA	Flow Weighted Average
GPD	Gallons per Day
HABS	Harmful Algae Blooms
IU	Industrial User
LEL	Lower Explosive Limit
MAHL	Maximum Allowable Headworks Loading
MAIL	Maximum Allowable Industrial Loading
MGD	Million Gallons per Day
MPN	Most Probable Number
MSDS	Material Safety Data Sheet –Replaced By SDS, Safety Data Sheet
NAICS	North American Industry Classification System (replaces SIC 1998)
NOV	Notice of Violation
NPDES	National Pollutant Discharge Elimination System
NRDC	Natural Resources Defense Council
NSPS	New Source Performance Standard
O&G	Oil and Grease
O&M	Operations and Maintenance
OCPSF	Organic Chemicals, Plastics, and Synthetic Fibers
P2	Pollution Prevention
PCA	Federal Water Pollution Control Act
PCI	Pretreatment Compliance Inspection
PCS	Permit Compliance System
PIRT	Pretreatment Implementation Review Task Force
POTW	Publicly Owned Treatment Works
PSES	Pretreatment Standards for Existing Sources
PSNS	Pretreatment Standards for New Sources
QA/QC	Quality Assurance/Quality Control
RCRA	Resource Conservation and Recovery Act
SIC	Standard Industrial Classification
SIU	Significant Industrial User

SPCC	Spill Prevention Control and Countermeasures
SNC	Significant Noncompliance
SSO	Sanitary Sewer Overflow
SUO	Sewer Use Ordinance
TCLP	Toxicity Characteristic Leaching Procedure
TIE	Toxicity Identification Evaluation
TOMP	Toxic Organic Management Program
TRE	Toxicity Reduction Evaluation
TRI	Toxic Release Inventory
TSS	Total Suspended Solids
TTO	Total Toxic Organics
USC	United States Code
UST	Underground Storage Tank
WET	Whole Effluent Toxicity
WWTP	Wastewater Treatment Plant
µ	Micron

Glossary of Compliance Terms *(Credit USEPA)*

This glossary includes a collection of terms used in this course and an explanation of each term. *As a pretreatment inspector, you will need knowledge and understanding of EPA terms.*

Act or "the Act" *[40 CFR §403.3(b)]*
The Federal Water Pollution Control Act, also known as the Clean Water Act, as amended, 33 USC 1251*et.seq.*

Approval Authority *[40 CFR §403.3(c)]*
The Director in an NPDES State with an approved State Pretreatment Program and the appropriate EPA Regional Administrator in a non-NPDES State or State without an approved pretreatment program.

Approved POTW Pretreatment Program or Program *[40 CFR §403.3(d)]*
A program administered by a POTW that meets the criteria established in 40 CFR Part 403 and which has been approved by a Regional Administrator or State Director.

Approved State Pretreatment Program
A program administered by a State that meets the criteria established in 40 CFR §403.10 and which has been approved by a Regional Administrator

Approved/Authorized State
A State with an NPDES permit program approved pursuant to section 402(b) of the Act and an approved State Pretreatment Program.

Baseline Monitoring Report (BMR) *[paraphrased from 40 CFR §403.12(b)]*
A report submitted by categorical industrial users (CIUs) within 180 days after the effective date of an applicable categorical standard, or at least 90 days prior to commencement of discharge for new sources, which contains specific facility information, including flow and pollutant concentration data. For existing sources, the report must also certify as to the compliance status of the facility with respect to the categorical standards.

Best Available Technology Economically Achievable (BAT)
A level of technology based on the best existing control and treatment measures that are economically achievable within the given industrial category or subcategory.

Best Management Practices (BMPs)
Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the U.S. BMPs also include treatment requirements, operating procedures and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.

Best Practicable Control Technology Currently Available (BPT)
A level of technology represented by the average of the best existing wastewater treatment performance levels within an industrial category or subcategory.

Best Professional Judgment (BPJ)
The method used by a permit writer to develop technology-based limitations on a case-by-case basis using all reasonably available and relevant data.

Blowdown
The discharge of water with high concentrations of accumulated solids from boilers to prevent plugging of the boiler tubes and/or steam lines. In cooling towers, blowdown is discharged to reduce the concentration of dissolved salts in the recirculating cooling water.

Bypass *[40 CFR §403.17(a)]*
The intentional diversion of wastestreams from any portion of an Industrial User's treatment facility.

Categorical Industrial User (CIU)
An industrial user subject to National categorical pretreatment standards.

Categorical Pretreatment Standards *[40 CFR § 403.6 and 40 CFR Parts 405-471*]
Limitations on pollutant discharges to POTWs promulgated by the EPA in accordance with Section 307 of the Clean Water Act, that apply to specific process wastewater discharges of particular industrial categories.

Chain of Custody (COC)
A record of each person involved in the possession of a sample from the person who collects the sample to the person who analyzes the sample in the laboratory.

Chronic
A stimulus that lingers or continues for a relatively long period of time, often one-tenth of the life span or more. Chronic should be considered a relative term depending on the life span of an organism. The measurement of chronic effect can be reduced growth, reduced reproduction, etc., in addition to lethality.

Clean Water Act (CWA)
The common name for the Federal Water Pollution Control Act. Public law 92-500; 33 U.S.C. 1251 et seq.; legislation which provides statutory authority for both NPDES and Pretreatment Programs.

Code of Federal Regulations (CFR)
A codification of Federal rules published annually by the Office of the Federal Register National Archives and Records Administration. Title 40 of the CFR contains the regulations for *Protection of the Environmen*t.

Combined Sewer Overflow (CSO)
A discharge of untreated wastewater from a combined sewer system at a point prior to the headworks of a publicly owned treatment works. CSOs generally occur during wet weather (rainfall or snowfall). During periods of wet weather, these systems become overloaded, bypass treatment works, and discharge directly to receiving waters.

Combined Wastestream Formula (CWF) *[paraphrased from 40 CFR §403.6(e)]*
Procedure for calculating alternative discharge limits at industrial facilities where a regulated wastestream from a categorical industrial user is combined with other wastestreams prior to treatment.

Compliance Schedule
A schedule of remedial measures included in a permit or an enforcement order, including a sequence of interim requirements (for example, actions, operations, or milestone events) that lead to compliance with the CWA and regulations.

Composite Sample
Sample composed of two or more discrete samples. The aggregate sample will reflect the average water quality covering the compositing or sample period.

Concentration-based Limit
A limit based upon the relative strength of a pollutant in a wastestream, usually expressed in mg/l.

Continuous Discharge
A discharge that occurs without interruption during the operating hours of a facility, except for infrequent shutdowns for maintenance, process changes or similar activities.

Control Authority *[paraphrased from 40 CFR § 403.12(a)]*
A POTW with an approved pretreatment program or the approval authority in the absence of a POTW pretreatment program.

Conventional Pollutants
BOD, TSS, fecal coliform, oil and grease, and pH

Daily Maximum Limitations
The maximum allowable discharge of pollutants during a 24-hour period. Where daily maximum limitations are expressed in units of mass, the daily discharge is the total mass discharged over the course of the day. Where daily maximum limitations are expressed in terms of a concentration, the daily discharge is the arithmetic average measurement of the pollutant concentration derived from all measurements taken that day.

Detection Limit
The minimum concentration of an analyte (substance) that can be measured and reported with a 99% confidence that the analyte concentration is greater than zero as determined by the procedure set forth in 40 CFR Part 136, Appendix B.

Development Document
Detailed report of studies conducted by the U.S. EPA for the purpose of establishing effluent guidelines and categorical pretreatment standards.

Dilute Wastestream *[paraphrased from 40 CFR §403.6(e)(1)(i)]*
For purposes of the combined wastestream formula, the average daily flow (at least a 30-day average) from : (a) boiler blowdown streams, non-contact cooling streams, storm water streams, and demineralized backwash streams; provided, however, that where such streams contain a significant amount of a pollutant, and the combination of such streams, prior to treatment, with an industrial user's regulated process wastestream(s) will result in a substantial reduction of that pollutant, the Control Authority, upon application of the industrial user, may exercise its discretion to determine whether such stream(s) should be classified as diluted or unregulated. In its application to the Control Authority, the industrial user must provide engineering, production, sampling and analysis, and such other information so the control authority can make its determination; or (b) sanitary wastestreams where such streams are not regulated by a categorical

pretreatment standard; or (c) from any process wastestreams which were, or could have been, entirely exempted from categorical pretreatment standards pursuant to paragraph 8 of the NRDC v. Costle Consent

Decree (12 ERC 1833) for one more of the following reasons (see Appendix D of 40 CFR Part 403):

a. the pollutants of concern are not detectable in the effluent from the industrial user (paragraph(8)(a)(iii));

b. the pollutants of concern are present only in trace amounts and are neither causing nor likely to cause toxic effects (paragraph (8)(a)(iii));

c. the pollutants of concern are present in amounts too small to be effectively deduced by technologies known to the Administrator (paragraph (8)(a)(iii)); or

d. the wastestream contains only pollutants which are compatible with the POTW (paragraph (8)(b)(I)).

Effluent Limitations Guideline

Any effluent limitations guidelines issued by the EPA pursuant to Section 304(b) of the CWA. These regulations are published to adopt or revise a national standard prescribing restrictions on quantities, rates, and concentrations of chemical, physical, biological, and other constituents which are discharged from point sources, in specific industrial categories (e.g., metal finishing, metal molding and casting, etc.).

Enforcement Response Plan *[paraphrased from 40 CFR §403.8(f)(5)]*

Step-by-step enforcement procedures followed by Control Authority staff to identify, document, and respond to violations.

Existing Source

Any source of discharge, the construction or operation of which commenced prior to the publication by the EPA of proposed categorical pretreatment standards, which will be applicable to such source if the standard is thereafter promulgated in accordance with Section 307 of the Act.

Federal Water Pollution Control Act (FWPCA)

The title of Public law 92-500; 33 U.S.C. 1251 et seq., also known as the Clean Water Act (CWA), enacted October 18, 1972.

Flow Weighted Average Formula (FWA) *[paraphrased from 40 CFR §403.6(e)]*

A procedure used to calculate alternative limits where wastestreams regulated by a categorical pretreatment standard and nonregulated wastestreams combine after treatment but prior to the monitoring point.

Flow Proportional Composite Sample

Combination of individual samples proportional to the flow of the wastestream at the time of sampling.

Fundamentally Different Factors *[paraphrased from 40 CFR §403.13]*

Case-by-case variance from categorical pretreatment standards based on the factors considered by the EPA in developing the applicable category/subcategory being fundamentally different than factors relating to a specific industrial user.

General Prohibitions *[40 CFR §403.5(a)(1)]*

No user shall introduce into a POTW any pollutant(s) which cause pass through or interference.

Grab Sample
A sample which is taken from a wastestream on a one-time basis with no regard to the flow of the wastestream and without consideration of time. A single grab sample should be taken over a period of time not to exceed 15 minutes.

Indirect Discharge or Discharge *[40 CFR §403.3(g)]*
The introduction of pollutants into a POTW from any non-domestic source regulated under section 307(b), (c), or (d) of the Act.

Industrial User (IU) or User *[40 CFR §403.3(h)]*
A source of indirect discharge.

Industrial Waste Survey
The process of identifying and locating industrial users and characterizing their industrial discharge.

Inhibition Concentration
Estimate of the toxicant concentration that would cause a given percent reduction (e.g., IC25) in a nonlethal biological measurement of the test organisms, such as reproduction or growth.

Interference *[paraphrased from 40 CFR §403.3(i)]*
A discharge which, alone or in conjunction with a discharge or discharges from other sources, both: (1)inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and (2) therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with ... [applicable] statutory provisions and regulations or permits issued there under (or more stringent State or local regulations)

Local Limits *[paraphrased 40 CFR § 403.5(c)]*
Specific discharge limits developed and enforced by POTWs upon industrial or commercial facilities to implement the general and specific discharge prohibitions listed in 40 CFR §§403.5(a)(1) and (b).

Monthly Average
The arithmetic average value of all samples taken in a calendar month for an individual pollutant parameter. The monthly average may be the average of all grab samples taken in a given calendar month, or the average of all composite samples taken in a given calendar month.

National Pollutant Discharge Elimination System (NPDES)
The national program for issuing, modifying, revoking and reissuing, terminating, monitoring and enforcing discharge permits from point sources to waters of the United States, and imposing and enforcing pretreatment requirements, under sections 307, 402, 318, and 405 of the CWA.

National Pretreatment Standard or Pretreatment Standard or Standard
[40 CFR §403.3(j)] Any regulation containing pollutant discharge limits promulgated by the EPA in accordance with section 307(b) and (c) of the Act, which applies to Industrial Users. This term includes prohibitive discharge limits established pursuant to §403.5.

New Source *[40 CFR §403.3(k)]*
Any building, structure, facility or installation from which there is or may be a discharge of pollutants, the construction of which commenced after the publication of proposed Pretreatment Standards under section 307(c) of the Act which will be applicable to such source if such standards are thereafter promulgated in accordance with that section *provided tha*t:
(a) The building, structure, facility or installation is constructed at a site at which no other discharge source is located; or
(b) The building, structure, facility or installation totally replaces the process or production equipment that causes the discharge of pollutants at an existing source; or
(c) The production or wastewater generating processes of the building, structure, facility, or installation are substantially independent of an existing source at the same site. In determining whether these are substantially independent, factors such as the extent to which the new facility is integrated with the existing plant, and the extent to which the new facility is engaged in the same general type of activity as the existing source, should be considered.
Construction on a site at which an existing source is located results in a modification rather than a new source if the construction does not create a new building, structure, facility, or installation meeting the criteria of paragraphs (k)(1)(ii), or (k)(1)(iii) of this section but otherwise alters, replaces, or adds to existing processor production equipment.
Construction of a new source, as defined under this paragraph has commenced if the owner or operator has:
(i) Begun, or caused to begin as part of a continuous onsite construction program:
(A) Any placement, assembly, or installation of facilities or equipment; or
(B) Significant site preparation work including clearing, excavation, or removal of existing buildings, structures, or facilities which is necessary for the placement, assembly, or installation of new source facilities or equipment, or
(C) Entered into a binding contractual obligation for the purchase of facilities or equipment which are intended to be used in its operation within a reasonable time. Options to purchase or contracts which can be terminated or modified without substantial loss, and contracts for feasibility, engineering, and design studies do not constitute a contractual obligation under this paragraph.

90-Day Final Compliance Report *[40 CFR §403.12(d)]*
A report submitted by categorical industrial users within 90 days following the date for final compliance with the standards. This report must contain flow measurement (of regulated process streams and other streams), measurement of pollutants, and a certification as to whether the categorical standards are being met.

Nonconventional Pollutants
Any pollutant that is neither a toxic pollutant nor a conventional pollutant (e.g., manganese, ammonia, etc.)

Non-Contact Cooling Water
Water used for cooling which does not come into direct contact with any raw material, intermediate product, waste product, or finished product. The only pollutant contributed from the discharge is heat.

Non-Regulated Wastestream
Unregulated and dilute wastestreams (not regulated by categorical standards).

Pass Through *[40 CFR §403.3(n)]*
A discharge which exits the POTW into waters of the United States in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation).

Periodic Compliance Report *[paraphrased from 40 CFR §403.12(e) & (h)]*
A report on compliance status submitted by categorical industrial users and significant noncategorical industrial users to the control authority at least semiannually (once every six months).

Point Source *[40 CFR 122.2]*
Any discernible, confined, and discrete conveyance, including but not limited to any pipe, ditch, channel, tunnel, conduit, well, discrete fixture, container, rolling stock concentrated animal feeding operation vessel, or other floating craft from which pollutants are or may be discharged.

Pollutant *[40 CFR 122.2]*
Dredged spoil, solid waste, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended (42 U.S.C. 2011 et seq.)), heat, wrecked or discarded equipment, rock, sand, cellar dirt, and industrial, municipal and agricultural waste discharged into water.

Pretreatment *[paraphrased from 40 CFR §403.3(q)]*
The reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a POTW.

Pretreatment Requirements *[40 CFR §403.3(r)]*
Any substantive or procedural requirement related to Pretreatment, other than a National Pretreatment Standard, imposed on an Industrial User.

Pretreatment Standards for Existing Sources (PSES)
Categorical Standards and requirements applicable to industrial sources that began construction prior to the publication of the proposed pretreatment standards for that industrial category. (see individual standards at 40 CFR Parts 405-471.)

Pretreatment Standards for New Sources (PSNS)
Categorical Standards and requirements applicable to industrial sources that began construction after the publication of the proposed pretreatment standards for that industrial category. (see individual standards at 40 CFR Parts 405-471.)

Priority Pollutant
Pollutant listed by the Administrator of the EPA under Clean Water Act section 307(a). The list of the current 126 Priority Pollutants can be found in 40 CFR Part 423 Appendix A.

Process Wastewater
Any water which, during manufacturing or processing, comes into contact with or results from the production or use of any raw material, intermediate product, finished product, byproduct, or waste product.

Production-Based Standards
A discharge standard expressed in terms of pollutant mass allowed in a discharge per unit of product manufactured.

Publicly Owned Treatment Works (POTW) *[40 CFR §403.3(o)]*
A treatment works as defined by section 212 of the Act, which is owned by a State or municipality (as defined by section 502(4) of the Act). This definition includes any devices or systems used in the storage, treatment, recycling, and reclamation of municipal sewage or industrial wastes of a liquid nature. It also includes sewers, pipes or other conveyances only if they convey wastewater to a POTW Treatment Plant.

The term also means the municipality as defined in section 502(4) of the Act, which has jurisdiction over the Indirect Discharges to and the discharges from such a treatment works.

Regulated Wastestream
For purposes of applying the combined wastestream formula, a wastestream from an industrial process that is regulated by a categorical standard.

Removal Credit *[paraphrased from 40 CFR §403.7]*
Variance from a pollutant limit specified in a categorical pretreatment standard to reflect removal by the POTW of said pollutant.

Representative Sample
A sample from a wastestream that is as nearly identical as possible in composition to that in the larger volume of wastewater being discharged and typical of the discharge from the facility on a normal operating day.

Sanitary Sewer Overflow (SSO)
Untreated or partially treated sewage overflows from a sanitary sewer collection system.

Self-Monitoring
Sampling and analyses performed by a facility to ensure compliance with a permit or other regulatory requirements.

Sewer Use Ordinance (SUO)
A legal mechanism implemented by a local government entity which sets out, among others, requirements for the discharge of pollutants into a publicly owned treatment works.

Significant Industrial User (SIU) *[paraphrased from 40 CFR §403.3(t)]*
(1) All users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR chapter I, subchapter N; and (2) Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling and boiler blowdown wastewater); contributes a process wastestream which makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority as defined in 40 CFR 403.12(a) on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)].

Significant Noncompliance (SNC) *[40 CFR §403.8(f)(2)(vii)]*
Industrial user violations meeting one or more of the following criteria:
1) Chronic violations of wastewater discharge limits, defined here as those in which sixty-six percent or more of all of the measurements taken during a six-month period exceed (by any magnitude) the daily maximum limit or the average limit for the same pollutant parameter;
2) Technical Review Criteria (TRC) violations, defined here as those in which thirty-three percent or more of all of the measurements for each pollutants parameter taken during a six-month period equal or exceed the product of the daily maximum limit or the average limit multiplied by the applicable TRC (TRC=1.4 for BOD, TSS, fats, oil, and grease, and 1.2 for all other pollutants except pH);
3) Any other violation of a pretreatment effluent limit (daily maximum or longer-term average) that the Control Authority determines has caused, alone or in combination with other dischargers, interference or pass through (including endangering the health of POTW personnel or the general public);
4) Any discharge of a pollutant that has caused imminent endangerment to human health, welfare or to the environment or has resulted in the POTW's exercise of its emergency authority under paragraph (f)(1)(vi)(B) of this section to halt or prevent such a discharge;
5) Failure to meet, within 90 days after the schedule date, a compliance schedule milestone contained in a local control mechanism or enforcement order for starting construction, completing construction, or attaining final compliance;
6) Failure to provide, within 30 days after the due date, required reports such as baseline monitoring reports, 90-day compliance reports, periodic self-monitoring reports, and reports on compliance with compliance schedules;
7) Failure to accurately report noncompliance;
8) Any other violation or group of violations which the Control Authority determines will adversely affect the operation or implementation of the local pretreatment program.

Slug Discharge *[40 CFR §403.8(f)(2)(v)]*
Any discharge of a non-routine, episodic nature, including but not limited to, an accidental spill or a noncustomary batch discharge.

Specific Prohibitions *[40 CFR §403.5(b)]*
The following pollutants shall not be introduced into a POTW:
1) Pollutants which create a fire or explosion hazard in the POTW, including but not limited to, wastestreams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR Part 261.21;
2) Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, unless the works is specifically designed to accommodate such discharges;
3) Solid or viscous pollutants in amounts which will cause obstruction to the flow in the POTW resulting in interference;
4) Any pollutant, including oxygen-demanding pollutants (BOD, etc.) Released in a discharge at a flow rate and/or concentration which will cause interference with the POTW;
5) Heat in amounts which will inhibit biological activity in the POTW resulting in interference, but in no case heat in such quantities that the temperature at the POTW treatment plant exceeds 40°C (104°F) unless the Approval Authority, upon request of the POTW, approves alternative temperature limits;
6) Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through;
7) Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity that may cause acute worker health and safety problems;

8) Any trucked or hauled pollutants, except at discharge points designated by the POTW.

Standard Industrial Classification (SIC)
A system developed by the U.S. Office of Management and Budget that is used to classify various types of business entities. Effective in 1998, the SIC scheme is replaced by the North American Industry Classification System (**NAICS**), although the EPA has not yet implemented this change.

Storm Water
Rainwater, snowmelt, and surface runoff and drainage.

Time Proportional Composite Sample
A sample consisting of a series of aliquots collected from a representative point in the discharge stream at equal time intervals over the entire discharge period on the sampling day.

Toxic Pollutant
Any pollutant listed as toxic under section 307(a)(1) of the CWA, or in the case of sludge use or disposal practices, any pollutant identified in regulations implementing section 405(d) of the CWA.

Toxicity Reduction Evaluation
A site-specific study conducted in a stepwise process designed to identify the causative agent(s) of effluent toxicity, isolate the sources of toxicity, evaluate the effectiveness of toxicity control options, and then confirm the reduction in effluent toxicity.

Toxicity Test
A procedure to determine the toxicity of a chemical or an effluent using living organisms. A toxicity test measures the degree of effect on exposed test organisms of a specific chemical or effluent.

Toxicity Identification Evaluation
Set of procedures to identify the specific chemicals responsible for effluent toxicity.

Unregulated Wastestream
For purposes of applying the combined wastestream formula, a wastestream not regulated by a categorical standard nor considered a dilute wastestream.

Upset *[paraphrased from 40 CFR §403.16(a)]*
An exceptional incident in which there is unintentional and temporary noncompliance with categorical Pretreatment Standards because of factors beyond the reasonable control of the Industrial User. An Upset does not include noncompliance to the extent caused by operational error, improperly designed treatment facilities, inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

Water Quality Criteria
Comprised of both numeric and narrative criteria. Numeric criteria are scientifically derived ambient concentrations developed by EPA or States for various pollutants of concern to protect human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal.

Water Quality Standard
A statute or regulation that consists of the beneficial designated use or uses of a waterbody, the numeric and narrative water quality criteria that are necessary to protect the use or uses of that particular waterbody, and an antidegradation statement.

Topic 1 - Pretreatment Overview

Topic 1 - Section Focus: You will learn the basics of the pretreatment program, POTW rules, industrial/commercial classifications and inspection procedures. At the end of this section, will be able to understand and describe Clean Water Act's rule concerning pretreatment and the rational for pretreatment. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 1 – Scope/Background: The Industrial Pretreatment program is a federally mandated program under the Clean Water Act, which controls the discharges of commercial and industrial facilities. The purpose of the pretreatment program is to block the introduction of pollutants, which can cause damage to equipment and interference with the wastewater treatment process, into the wastewater collection and transmission system. The program is important in preventing harm to workers, the public and the environment.

Domestic waste overflow at the headworks. Yes, incredibly headworks do overflow, usually due to rags, grease and debris from a lack of a sewer or pretreatment ordinance or enforcement. We do not like to see this happening and are very careful about letting the public and state regulatory agencies see this activity. One activity the State does not want to see but will happen during a rainstorm is bypassing untreated waste to the outfall.

Section 1.1 Pretreatment Introduction

Pollutants in industrial wastewater may compromise municipal treatment plant processes or contaminate waters of the state. To protect municipal treatment plants and the environment, the Pretreatment Program requires industrial dischargers to use treatment techniques and management practices to reduce or eliminate the discharge of harmful pollutants to sanitary sewers. The Pretreatment Program is a core part of the Clean Water Act's National Pollutant

Discharge Elimination System (NPDES). The National Pretreatment Program's primary goal is to protect Publicly Owned Treatment Works (POTWs) and the environment from adverse impacts that might occur when pollutants are discharged into a sewage system.

The Specific Pretreatment Program Goals are as Follows:

- Prevent the introduction of pollutants into the POTW that will pass through the treatment works or are otherwise incompatible with treatment
- Prevent the introduction of pollutants that could interfere with POTW operations, including interference with the POTW's chosen sewage sludge use and disposal practices, as well as pollutants that could threaten worker health and safety
- Improve opportunities to recycle and reclaim municipal and industrial wastewaters and sludges

Discharges to a POTW have the potential to cause the POTW to violate its National Pollutant Discharge Elimination System (NPDES) permit if the treatment system is not able to adequately remove the pollutant contained in the discharge or the pollutant otherwise damages or disrupts operations of the POTW. Industrial discharges to POTWs have historically been a significant source of pollutants in our nation's waters. Certain industrial discharges can interfere with the operation of POTWs, leading to the discharge of untreated or inadequately treated wastewater into rivers, lakes, and such.

Some pollutants are not compatible with biological wastewater treatment at POTWs and may pass through the treatment plant untreated. This pass through of pollutants affects the surrounding environment, occasionally causing fish kills or other detrimental alterations of the receiving waters. Even when POTWs have the capability to remove toxic pollutants from wastewater, the toxics can end up in the POTW's sewage sludge, which in many places is land applied to food crops, parks, or golf courses as fertilizer or soil conditioner.

The Clean Water Act (CWA or the Act) addresses this problem by requiring the U.S. Environmental Protection Agency (EPA) to promulgate federal standards for the pretreatment of wastewater discharged to a POTW [33 U.S.C. § 1317(b)(3)]. Section 307(d) of the Act prohibits discharge in violation of any pretreatment standard [33 U.S.C. § 1317(d)]. The CWA prohibits the introduction of pollutants into a POTW that might pass through or interfere with the POTW and its operations.

Discharge of a pollutant is a term specifically defined in the CWA to mean the discharge of a pollutant to navigable waters, and such discharges are generally prohibited except in compliance with the Act and a permit under section 402 of the Act. While this document uses the word discharge in its commonly understood meaning when referring to the introduction of pollutants into a POTW, such a discharge is not a CWA discharge of pollutants to navigable waters.

To address indirect discharges from industries to POTWs, EPA has established the National Pretreatment Program as a component of the NPDES Permitting Program. The National Pretreatment Program requires industrial and commercial dischargers to treat or control pollutants in their wastewater before discharge to POTWs. EPA has chosen to promulgate pretreatment standards at the same time it promulgates effluent limitations guidelines for industry categories of direct dischargers under sections 301(b) and 304(b) of the Act [33 U.S.C. § 1311(b) and 1314(b)].

These pretreatment regulations are applicable to industrial indirect dischargers—those discharging to POTWs—and are known as categorical pretreatment standards.

EPA has also developed other nationally applicable pretreatment standards (national pretreatment standards) under section 307(b) in its General Pretreatment Regulations for Existing and New Sources of Pollution (Pretreatment Regulations) at 40 CFR Part 403. Such pretreatment standards are applicable to any user of a POTW, defined as a source of an indirect discharge [40 CFR 403.3(i)].

These national pretreatment standards include (1) a general prohibition and (2) specific prohibitions.

The general prohibition prohibits any user of a POTW from introducing a pollutant into the POTW that will cause pass through or interference. EPA's regulations define both pass through and interference. Pass through is defined as a discharge that exits the POTW into waters of the United States in quantities or concentrations that, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit.

Interference includes a discharge that, alone or in conjunction with a discharge from other sources will, among other things, prevent sewage sludge use in compliance with described regulatory provisions including section 405 of the Act [40 CFR 403.3(k)(2)]. In addition, under the Pretreatment Regulations, certain POTWs must develop and enforce local limits to implement the general and specific prohibitions of section 403.5(a)(1) and (b). Local limits that are developed by a POTW in accordance with the regulations are pretreatment standards for purposes of section 307(d) of the CWA [40 CFR 403.5(d)]. See also 40 CFR 403.3(l) ("The term National Pretreatment Standard, Pretreatment Standard, or Standard ... includes any prohibitive discharge limits established pursuant to § 403.5.").

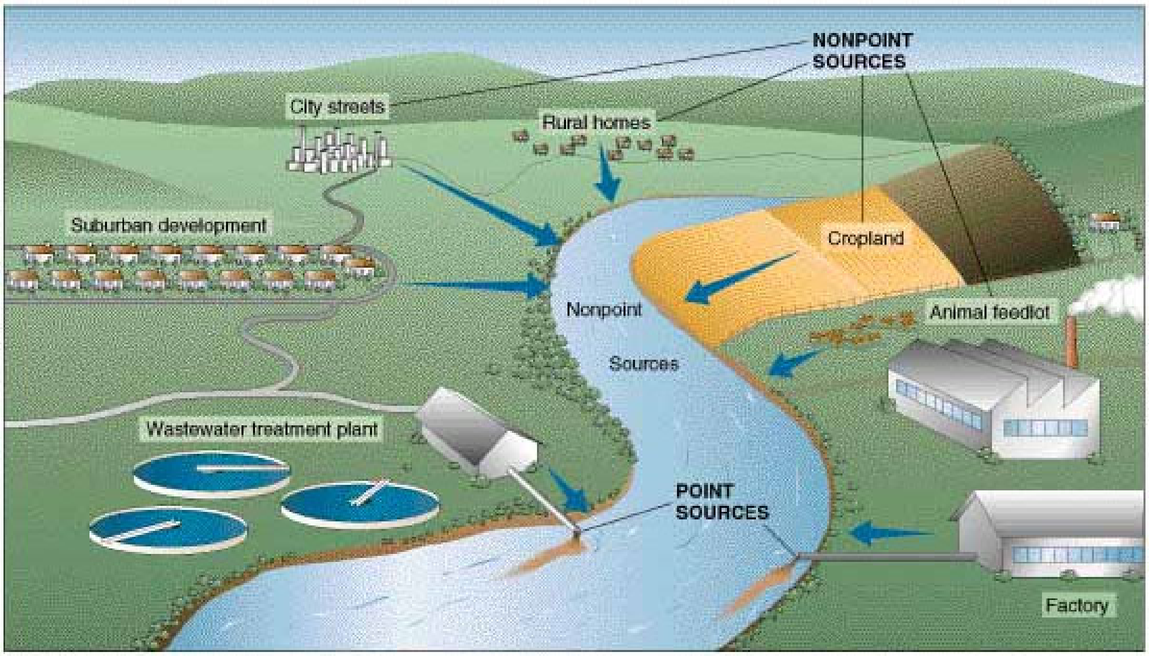
Finally, states and POTWs always have the option of establishing more stringent requirements if such requirements are authorized and necessary, pursuant to their state or local law. Generally, this document describes only the National Pretreatment Program requirements established pursuant to the CWA and implementing regulations.

Where state or local requirements are implemented in the same control mechanism, the control mechanism should clearly identify the applicable local or state regulation or enabling legislation. (For a discussion of other conditions in IU permits based on state or local requirements, see Section 3.1.2.7.) Therefore, each the pretreatment program can be a mixture of federal, state, and local standards and requirements.

National Pretreatment Program's Purpose
It is a cooperative effort of federal, state, and local environmental regulatory agencies established to protect water quality. The EPA authorizes the NPDES permit program to state, tribal, and territorial governments to perform permitting, administrative, and enforcement tasks for discharges to surface waters (NPDES program), EPA and authorized NPDES state pretreatment programs approve local municipalities to perform permitting, administrative, and enforcement tasks for discharges into the municipalities' publicly owned treatment works (POTWs). The national pretreatment program is a component of the NPDES program.

National Pretreatment Program's Objectives

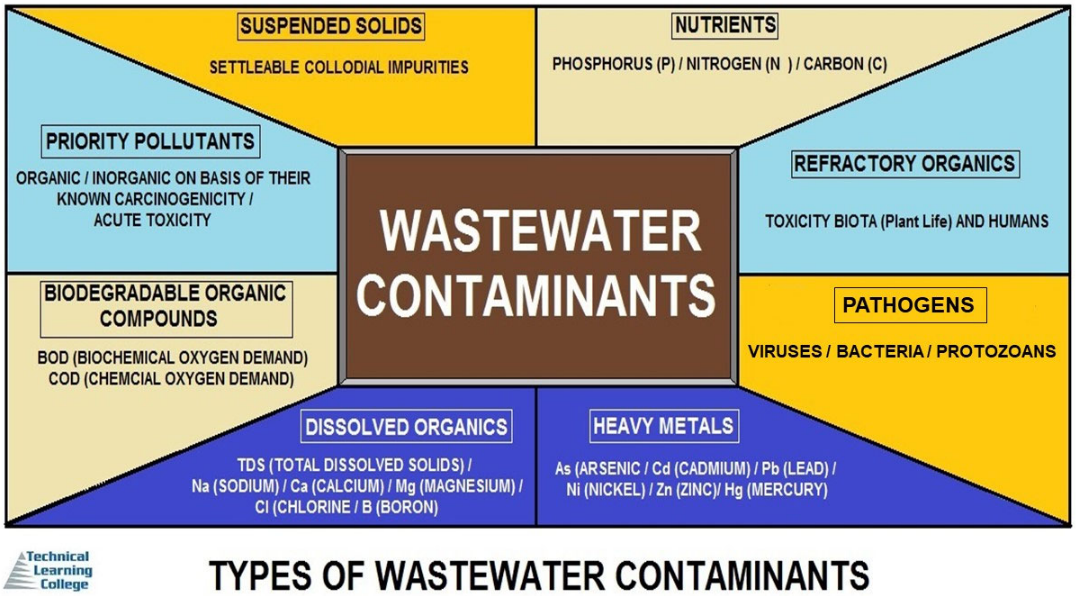
The national pretreatment program requires nondomestic dischargers to comply with pretreatment standards to ensure the goals of the Clean Water Act (CWA) are attained.



POINT SOURCE VS NON-POINT SOURCE

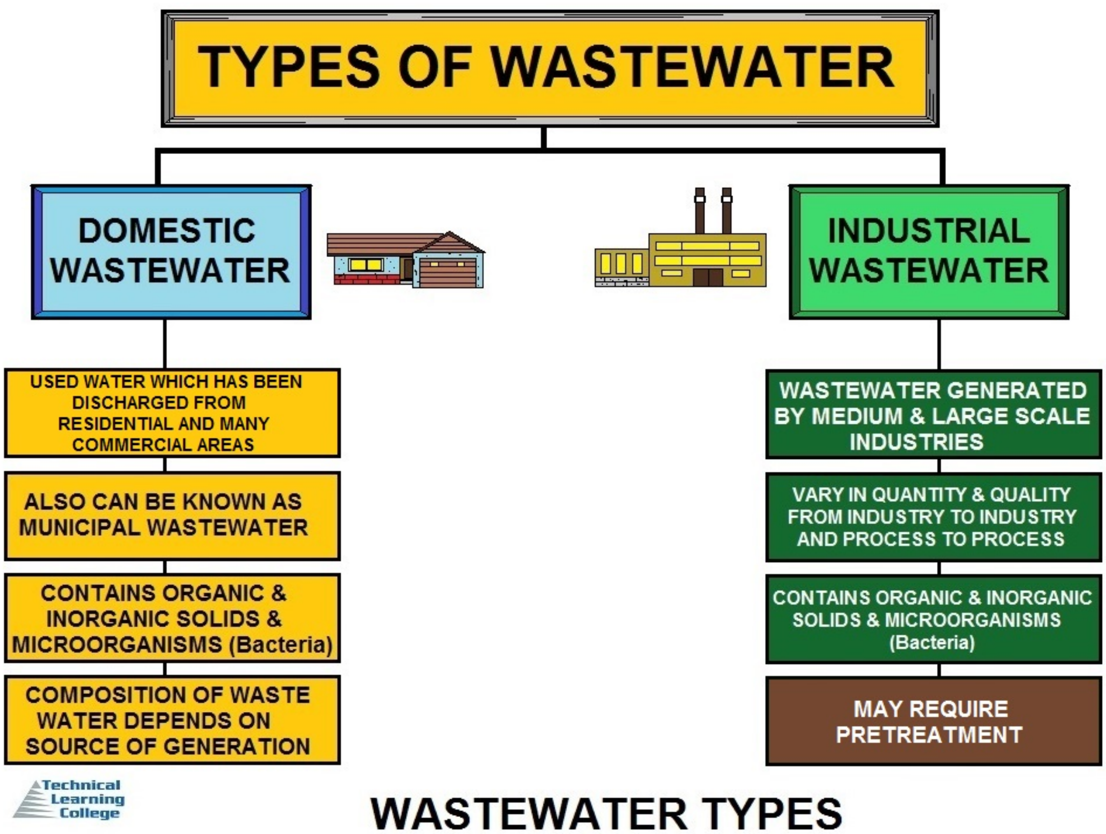
The objectives of the program are to:

- prevent the introduction of pollutants into a POTW that will interfere with its operation, including interference. A discharge that, alone or in conjunction with a discharge or discharges from other sources, both (1) inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use, or disposal; and (2) therefore is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation) or of the prevention of sewage sludge use or disposal in compliance with ... [applicable] statutory provisions and regulations or permits issued thereunder (or more stringent state or local regulations). [paraphrased from 40 CFR 403.3(k)] with its use or disposal of municipal sludge,
- prevent the introduction of pollutants into a POTW that will pass through the treatment works or otherwise be incompatible with it, and
- improve opportunities to recycle and reclaim municipal and industrial wastewaters and sludges.



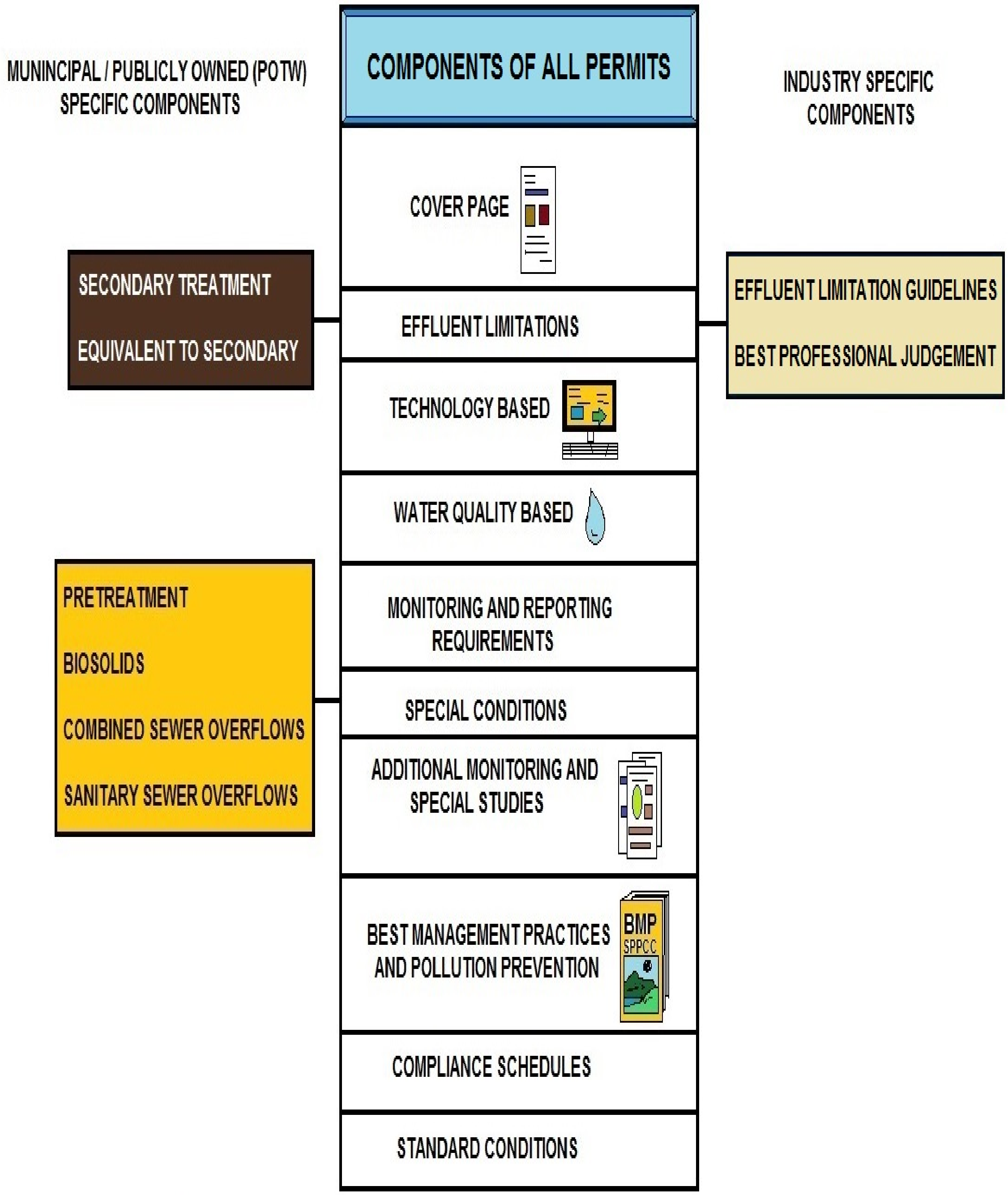
TYPES OF WASTEWATER CONTAMINANTS

Above are the common wastewater contaminants that we must deal with correctly to achieve our permit requirements.



WASTEWATER TYPES

The diagram above shows the difference between domestic wastewater and industrial wastewater



PERMIT COMPONENTS

You must abide by your permit requirements and not deviate from them based on information presented in this course.

1.2 Publically Owned Treatment Works (POTWS)

Generally, POTWs are designed to treat domestic sewage only. Simply defined, the typical POTW treatment process consists of primary and secondary treatment, along with some form of solids handling. Primary treatment is designed to remove large solids (e.g., rags and debris) and smaller inorganic grit. Typical primary treatment operations include screening and settling. Secondary treatment removes organic contaminants using microorganisms to consume biodegradable organics.

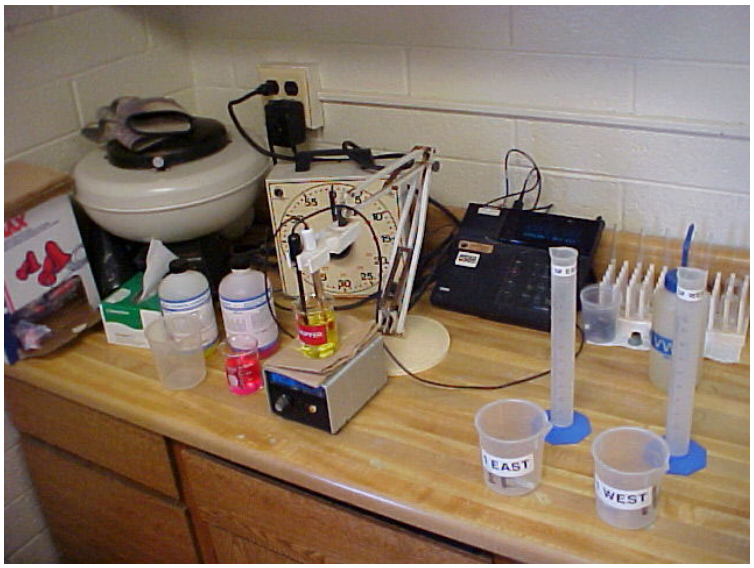
Odor control facility at a modern wastewater treatment plant--the photo on the right is of an enclosed *"headworks"* to help lower odor complaints.

Activated sludge, trickling filters, and rotating biological contactors are examples of common secondary treatment operations. Depending on effluent discharge requirements, POTWs may perform other "*advanced treatment*" operations such as nitrification (to convert ammonia and nitrite to the less toxic nitrate), denitrification (to convert nitrate to molecular nitrogen).

Aerated Wastewater – Activated sludge

Figure 1.2 Conventional Pollutant Introduction

- Biochemical Oxygen Demand (BOD)
- Total Suspended Solids (TSS)
- Fecal Coliform
- pH
- Oil and Grease (O&G)



A small wastewater treatment operator’s lab.

Physical-Chemical Treatment

Physical-chemical treatment (to remove dissolved metals and organics), and disinfection (to kill any remaining pathogens). After treatment is complete, effluent is discharged to the receiving stream, typically a creek, river, lake, estuary or ocean. Some POTWs may apply treated effluent directly to golf courses, parkland, or croplands.

Both primary and secondary treatment processes generate waste solids, known as sewage sludge or biosolids. Sludges from the treatment process may be used productively (i.e., as fertilizer or soil conditioner), disposed of in a landfill or incinerated in a dedicated sewage sludge incinerator with the ash also disposed of in a landfill.

As described above, POTWs are designed to treat typical household wastes and biodegradable commercial and biodegradable industrial wastes. The Clean Water Act (**CWA**) and the EPA define the contaminants from these sources as conventional pollutants.

Conventional pollutants are identified in Figure 1.2 above and include those specific pollutants that are expected to be present in domestic discharges to POTWs.

Commercial and industrial facilities may, however, discharge toxic pollutants that the treatment plant is neither designed for nor able to remove.

1.3 What is in Wastewater? *(Credit USEPA)*

Wastewater is mostly water by weight. Other materials make up only a small portion of wastewater, but can be present in large enough quantities to endanger public health and the environment. Because practically anything that can be flushed down a toilet, drain, or sewer can be found in wastewater, even household sewage contains many potential pollutants. The wastewater components that should be of most concern to homeowners and communities are those that have the potential to cause disease or detrimental environmental effects.

Organisms

Many different types of organisms live in wastewater and some are essential contributors to treatment. A variety of bacteria, protozoa, and viruses work to break down certain carbon-based (organic) pollutants in wastewater by consuming them. Through this process, organisms turn wastes into carbon dioxide, water, or new cell growth.

Bacteria and other microorganisms are particularly plentiful in wastewater and accomplish most of the treatment. Most wastewater treatment systems are designed to rely in large part on biological processes.

Pathogens

Many disease-causing viruses, parasites, and bacteria are also present in wastewater and enter from almost anywhere in the community. These pathogens often originate from people and animals that are infected with or are carriers of a disease. Graywater and blackwater from typical homes contain enough pathogens to pose a risk to public health. Other likely sources in communities include hospitals, schools, farms, and food processing plants.

Some illnesses from wastewater-related sources are relatively common. Gastroenteritis can result from a variety of pathogens in wastewater, and cases of illnesses caused by the parasitic protozoa Giardia lambia and Cryptosporidium are not unusual in the U.S. Other important wastewater-related diseases include hepatitis A, typhoid, polio, cholera, and dysentery.

Outbreaks of these diseases can occur as a result of drinking water from wells polluted by wastewater, eating contaminated fish, or recreational activities in polluted waters. Some illnesses can be spread by animals and insects that come in contact with wastewater.

Even municipal drinking water sources are not completely immune to health risks from wastewater pathogens. Drinking water treatment efforts can become overwhelmed when water resources are heavily polluted by wastewater. For this reason, wastewater treatment is as important to public health as drinking water treatment.

Organic Matter

Organic materials are found everywhere in the environment. They are composed of the carbon-based chemicals that are the building blocks of most living things. Organic materials in wastewater originate from plants, animals, or synthetic organic compounds, and enter wastewater in human wastes, paper products, detergents, cosmetics, foods, and from agricultural, commercial, and industrial sources.

Organic compounds normally are some combination of carbon, hydrogen, oxygen, nitrogen, and other elements. Many organics are proteins, carbohydrates, or fats and are biodegradable, which means they can be consumed and broken down by organisms.

However, even biodegradable materials can cause pollution. In fact, too much organic matter in wastewater can be devastating to receiving waters.

Large amounts of biodegradable materials are dangerous to lakes, streams, and oceans, because organisms use dissolved oxygen in the water to break down the wastes. This can reduce or deplete the supply of oxygen in the water needed by aquatic life, resulting in fish kills, odors, and overall degradation of water quality. This is called eutrophication. The amount of oxygen organisms need to break down wastes in wastewater is referred to as the biochemical oxygen demand (BOD) and is one of the measurements used to assess overall wastewater strength.

Some organic compounds are more stable than others and cannot be quickly broken down by organisms, posing an additional challenge for treatment. This is true of many synthetic organic compounds developed for agriculture and industry.

In addition, certain synthetic organics are highly toxic. Pesticides and herbicides are toxic to humans, fish, and aquatic plants and often are disposed of improperly in drains or carried in stormwater. In receiving waters, they kill or contaminate fish, making them unfit to eat. They can also damage processes in treatment plants. Benzene and toluene are two toxic organic compounds found in some solvents, pesticides, and other products. New synthetic organic compounds are being developed all the time, which can complicate treatment efforts.

Fats, Oil and Grease

As we covered earlier, fatty organic materials from animals, vegetables, plastics, and petroleum also are not quickly broken down by bacteria and can cause pollution in receiving environments. When large amounts of oils and greases are discharged to receiving waters from community systems, they increase BOD and they may float to the surface and harden, causing aesthetically unpleasing conditions. They also can trap trash, plants, and other materials, causing foul odors, attracting flies, mosquitoes and other disease vectors. In some cases, too much oil and grease causes septic conditions in ponds and lakes by preventing oxygen from the atmosphere from reaching the water.

Onsite systems also can be harmed by too much oil and grease, which can clog onsite system drainfield pipes and soils, adding to the risk of system failure. Excessive grease also adds to the septic tank’s scum layer, requiring more frequent tank pumping. Both possibilities can result in significant costs to homeowners.

Petroleum-based waste oils used for motors and industry are considered hazardous waste and should be collected and disposed of separately from wastewater.

Inorganics

Inorganic minerals, metals, and compounds, such as sodium, potassium, calcium, magnesium, cadmium, copper, lead, nickel, and zinc are common in wastewater from both residential and nonresidential sources. They can originate from a variety of sources in the community including industrial and commercial sources, stormwater, inflow and infiltration from cracked pipes and leaky manhole covers. Most inorganic substances are relatively stable, and cannot be broken down easily by organisms in wastewater.

Large amounts of many inorganic substances can contaminate soil and water. Some are toxic to animals and humans and may accumulate in the environment. For this reason, extra treatment steps are often required to remove inorganic materials from industrial wastewater sources.

For example, heavy metals which are discharged with many types of industrial wastewaters are difficult to remove by conventional treatment methods. Although acute poisonings from heavy metals in drinking water are rare in the U.S., potential long-term health effects from ingesting small amounts of some inorganic substances over an extended period of time are possible. We will cover this area in greater detail later.

Nutrients

Nutrients in quantities that exceed the affected waterbody's ability to assimilate them results in a condition called eutrophication or cultural enrichment. When an excess of these nutrients over-stimulates the growth of water plants, the result causes unsightly conditions, interferes with boating activities and drinking water treatment processes, and causes unpleasant and disagreeable tastes and odors in drinking water. It may be linked to harmful Algae Blooms (HABS) which are similar to the recently mentioned "red tides" where the algae produces toxins dangerous to humans and animals.

Uncontrolled algae growth blocks out sunlight and chokes aquatic plants and animals by depleting dissolved oxygen in the water at night. Oxygen is also depleted by the decomposition of excessive amounts of dead algae and plants. The release of nutrients in quantities that exceed the affected waterbody's ability to assimilate them results in a condition called eutrophication or cultural enrichment.

Nutrients are chemical elements or compounds essential for plant and animal growth. Nutrient parameters include ammonia, organic nitrogen, Kjeldahl nitrogen, nitrate nitrogen (for water only) and total phosphorus. High amounts of nutrients have been associated with eutrophication, or over fertilization of a water body, while low levels of nutrients can reduce plant growth and (for example) starve higher level organisms that consume phytoplankton.

Nutrients from wastewater have also been linked to ocean "red tides" that poison fish and cause illness in humans. Nitrogen in drinking water may contribute to miscarriages in pregnant women and is the cause of a serious illness in infants called methemoglobinemia or "blue baby syndrome." We will cover this area in greater detail later.

Solids

Solid materials in wastewater can consist of organic and/or inorganic materials and organisms. The solids must be significantly reduced by treatment or they can increase BOD when discharged to receiving waters and provide places for microorganisms to escape disinfection. They also can clog soil absorption fields in onsite systems. Listed are the characteristics of solids.

- Settleable solids-Certain substances, such as sand, grit, and heavier organic and inorganic materials settle out from the rest of the wastewater stream during the preliminary stages of treatment. On the bottom of settling tanks and ponds, organic material makes up a biologically active layer of sludge that aids in treatment.
- Suspended solids-Materials that resist settling may remain suspended in wastewater. Suspended solids in wastewater must be treated, or they will clog soil absorption systems or reduce the effectiveness of disinfection systems.
- Dissolved solids-Small particles of certain wastewater materials can dissolve like salt in water. Some dissolved materials are consumed by microorganisms in wastewater, but others, such as heavy metals, are difficult to remove by conventional treatment. Excessive amounts of dissolved solids in wastewater can have adverse effects on the environment.

Gases
Certain gases in wastewater can cause odors, these corrode pipes and pumps and affects treatment, or are potentially dangerous. Hydrogen sulfide and Methane gas, for example, are byproducts of anaerobic biological treatment and is highly corrosive, flammable, smells like rotten eggs and at high concentrations, is deadly to breath. Special precautions need to be taken near septic tanks, manholes, treatment plants, and other areas where wastewater gases can collect. The gases hydrogen sulfide and ammonia can be toxic and pose asphyxiation hazards. Ammonia as a dissolved gas in wastewater also is dangerous to fish. Both gases emit odors, which can be a serious nuisance.

Unless effectively contained or minimized by design and location, wastewater odors can affect the mental well-being and quality of life of residents. In some cases, odors can even lower property values and affect the local economy. We will cover this area in greater detail later.

Dispose of Household Hazardous Wastes Safely
Many household products are potentially hazardous to people and the environment and never should be flushed down drains, toilets, or storm sewers. Treatment plant workers can be injured and wastewater systems can be damaged as a result of improper disposal of hazardous materials.

Other hazardous chemicals cannot be treated effectively by municipal wastewater systems and may reach local drinking water sources. When flushed into septic systems and other onsite systems, they can temporarily disrupt the biological processes in the tank and soil absorption field, allowing hazardous chemicals and untreated wastewater to reach groundwater.

Some examples of hazardous household materials include motor oil, transmission fluid, antifreeze, paint, paint thinner, varnish, polish, wax, solvents, pesticides, rat poison, oven cleaner, and battery fluid. Many of these materials can be recycled or safely disposed of at community recycling centers. We will cover this area in greater detail later.

Other Important Wastewater Characteristics
In addition to the many substances found in wastewater, there are other characteristics system designers and operators use to evaluate wastewater. For example, the color, pH, odor, and turbidity of wastewater give clues about the amount and type of pollutants present and treatment necessary. The following are some other important wastewater characteristics that can affect public health and the environment, as well as the design, cost, and effectiveness of treatment.

Temperature
The best temperatures for wastewater treatment probably range from 77 to 95 degrees Fahrenheit. In general, biological treatment activity accelerates in warm temperatures and slows in cool temperatures, but extreme hot or cold can stop treatment processes altogether. Therefore, some systems are less effective during cold weather and some may not be appropriate for very cold climates.

Wastewater temperature also affects receiving waters. Hot water, for example, which is a byproduct of many manufacturing processes, can be a pollutant. When discharged in large quantities, it can raise the temperature of receiving streams locally and disrupt the natural balance of aquatic life.

pH
The acidity or alkalinity of wastewater affects both treatment and the environment. Low pH indicates increasing acidity; while a high pH indicates increasing alkalinity (a pH of 7 is neutral). The pH of wastewater needs to remain between 6 and 9 to protect organisms. Acids and other substances that alter pH can inactivate treatment processes when they enter wastewater from industrial or commercial sources. We will cover this area in greater detail later.

Biochemical Oxygen Demand
Biochemical Oxygen Demand (**BOD or BOD5**) is an indirect measure of biodegradable organic compounds in water, and is determined by measuring the dissolved oxygen decrease in a controlled water sample over a five-day period.

During this five-day period, **aerobic** (oxygen-consuming) bacteria decompose organic matter in the sample and consume dissolved oxygen in proportion to the amount of organic material that is present. In general, a high BOD reflects high concentrations of substances that can be biologically degraded, thereby consuming oxygen and potentially resulting in low dissolved oxygen in the receiving water.

The BOD test was developed for samples dominated by oxygen-demanding pollutants like sewage. While its merit as a pollution parameter continues to be debated, BOD has the advantage of a long period of record.

Organic Carbon
Most organic carbon in water occurs as partly degraded plant and animal materials, some of which are resistant to microbial degradation. Organic carbon is important in the estuarine food web and is incorporated into the ecosystem by photosynthesis of green plants, then consumed as carbohydrates and other organic compounds by higher animals. In another process, formerly living tissue containing carbon is decomposed as detritus by bacteria and other microbes.

Total Organic Carbon (TOC)
TOC bears a direct relationship with biological and chemical oxygen demand. High levels of TOC can result from human sources, high oxygen demand being the main concern.

Priority Pollutants
Priority Pollutants refer to a list of 126 specific pollutants that includes heavy metals and specific organic chemicals. The priority pollutants are a subset of “***toxic pollutants***” as defined in the Clean Water Act.

These 126 pollutants were assigned a high priority for development of water quality criteria and effluent limitation guidelines because they are frequently found in wastewater. Many of the heavy metals, pesticides, and other chemicals listed on the following page are on the priority pollutant list.

Parshall Fume and Ultrasonic Flow Meter

Notice the debris, most POTW's will write a NOV for uncleanness, the POTW's that do not write NOV's will usually not have an ordinance in place.

1.3.1 Flow Section

Whether a system serves a single home or an entire community, it must be able to handle fluctuations in the quantity and quality of wastewater it receives to ensure proper treatment is provided at all times. Systems that are inadequately designed or hydraulically overloaded may fail to provide treatment and allow the release of pollutants to the environment.

To design systems are as safe and as cost-effective as possible, engineers must estimate the average and maximum (peak) amount of flows generated by various sources. Because extreme fluctuations in flow can occur during different times of the day and on different days of the week, estimates are based on observations of the minimum and maximum amounts of water used on an hourly, daily, weekly, and seasonal basis. The possibility of instantaneous peak flow events that result from several or all water-using appliances or fixtures being used at once is also taken into account.

The number, type, and efficiency of all water-using fixtures and appliances at the source is factored into the estimate (for example, the number and amount of water normally used by faucets, toilets, and washing machines), as is the number of possible users or units that can affect the amount of water used (for example, the number of residents, bedrooms, customers, students, patients, seats, or meals served). According to studies, water use in many homes is lowest from about midnight to 5 a.m., averaging less than one gallon per person per hour, but then rises sharply in the morning around 6 a.m. to a little over 3 gallons per person per hour. During the day, water use drops off moderately and rises again in the early evening hours.

Weekly peak flows may occur in some homes on weekends, especially when all adults work during the week. In U.S. homes, average water use is approximately 45 gallons per person per day, but may range from 35 to 60 gallons or more.

Peak flows at stores and other businesses typically occur during business hours and during meal times at restaurants. Rental properties, resorts, and commercial establishments in tourist areas may have extreme flow variations seasonally.

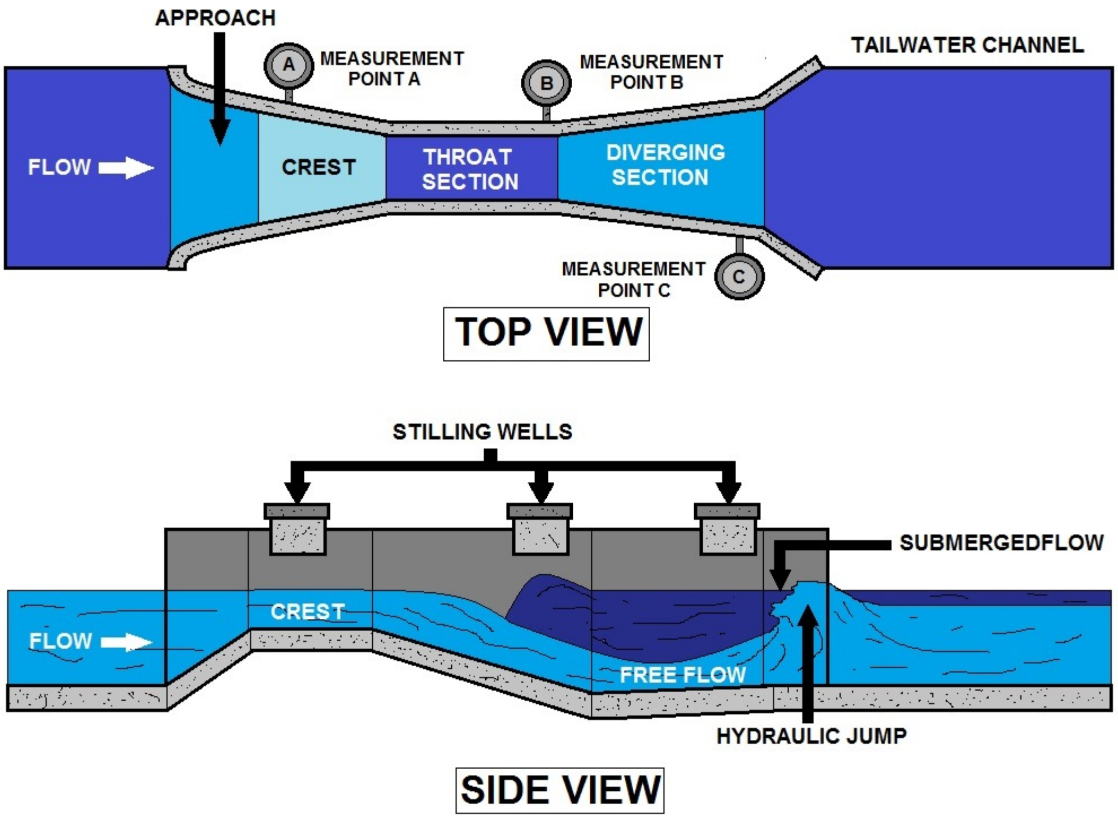
Estimating flow volumes for centralized treatment systems is a complicated task, especially when designing a new treatment plant in a community where one has never existed previously.

Engineers must allow for additional flows during wet weather due to inflow and infiltration of extra water into sewers. Excess water can enter sewers through leaky manhole covers and cracked pipes and pipe joints, diluting wastewater, which affects its overall characteristics. This can increase flows to treatment plants sometimes by as much as three or four times the original design load.

The main focus of wastewater treatment plants is to reduce the BOD and COD in the effluent discharged to natural waters, meeting state and federal discharge criteria. Wastewater treatment plants are designed to function as "microbiology farms," where bacteria and other microorganisms are fed oxygen and organic waste.

Treatment of wastewater usually involves biological processes such as the activated sludge system in the secondary stage after preliminary screening to remove coarse particles and primary sedimentation that settles out suspended solids.

These secondary treatment steps are generally considered environmental biotechnologies that harness natural self-purification processes contained in bioreactors for the biodegradation of organic matter and bioconversion of soluble nutrients in the wastewater. We will cover this area in greater detail later.



PARSHALL FLUME DIAGRAM

The **Parshall flume** is an economical and accurate way of measuring the flow of water in open channels and non-full pipes. The flume was originally developed to measure surface waters, water rights apportionment, and irrigation flows, but its use has expended to include measuring the flow of sewage (both in pipe and treatment plants), industrial discharges, and seepage from dams. We will go into more detail ion this subject in the next topic section.

1.4 What is a POTW Pretreatment Program?

The term "pretreatment" refers to the requirement that non-domestic sources discharging wastewater to POTWs control their discharges, and meet limits established by the EPA, and/or your state or the local municipality (Control Authority) on the amount of pollutants allowed to be discharged. The control of the pollutants may necessitate treatment prior to discharge to the POTW (therefore the term "pretreatment").

Limits may often be met by the non-domestic source through pollution prevention techniques (product substitution, recycle and reuse of materials, more efficient production practices, improved environmental management systems, etc.), pretreatment of wastewater, or implementation of best management practices.

The National Pretreatment Program is a cooperative effort of federal, state, and local regulatory environmental agencies established to protect water quality. The program is designed to reduce the level of pollutants discharged by industry and other non-domestic wastewater sources into municipal sewer systems, and thereby, reduce the amount of pollutants released into the environment from these sources.

The national pretreatment program was established by Congress under authority of the Federal Water Pollution Control Act of 1972 (Pub. L. 92-500) as amended by the Clean Water Act of 1977 (Pub. L. 95-217). Implementation requirements of the pretreatment portions of these laws were first codified into 40 Code of Federal Regulations (CFR) Part 403 in 1978.

Objectives of the Pretreatment Program:

1. Protect publicly owned treatment works (POTW) from pollutants that may cause interference with sewage treatment plant operations.
2. Prevent introducing pollutants into a POTW that could cause pass through of untreated pollutants to receiving waters.
3. Manage pollutant discharges into a POTW to improve opportunities for reuse of POTW wastewater and residuals (sewage sludge).
4. Prevent introducing pollutants into a POTW that could cause worker health or safety concerns, or that could pose a potential endangerment to the public or to the environment.

POTWs

Publicly owned treatment works (POTWs) collect wastewater from homes, commercial buildings, and industrial facilities and transport it via a series of pipes, known as a collection system, to the treatment plant. Here, the POTW removes harmful organisms and other contaminants from the sewage so it can be discharged safely into the receiving stream. Generally, POTWs are designed to treat domestic sewage only.

However, POTWs also receive wastewater from industrial (non-domestic) users. The General Pretreatment Regulations establish responsibilities of Federal, State, and local government, industry and the public to implement Pretreatment Standards to control pollutants from the industrial users which may pass through or interfere with POTW treatment processes or which may contaminate sewage sludge.

1.4.1 National Pretreatment Program
The National Pretreatment Program identifies specific requirements that apply to all IUs, additional requirements that apply to all SIUs, and certain requirements that only apply to CIUs.

The objectives of the National Pretreatment Program are achieved by applying and enforcing three types of discharge standards:

- **prohibited discharge standards**
- **categorical Pretreatment standards**
- **local limits**

Term Review

Aerobic (AIR-O-bick) - a condition in which free or dissolved oxygen is present in the aquatic environment.

Aerobic Bacteria (aerobes) – bacteria which will live and reproduce only in an environment containing oxygen. Oxygen combined chemically, such as in water molecules (H_2O), cannot be used for respiration by aerobes.

Anaerobic (AN-air O-bick) - a condition in which ***"free"*** or dissolved oxygen is not present in the aquatic environment.

Anaerobic Bacteria (anaerobes) – bacteria that thrive without the presence of oxygen.

Saprophytic Bacteria – bacteria that break down complex solids to volatile acids.

Methane Fermenters – bacteria that break down the volatile acids to methane (CH_4) carbon dioxide (CO_2) and water (H_2O).

Oxidation – the addition of oxygen to an element or compound, or removal of hydrogen or an electron from an element or compound in a chemical reaction. The opposite of reduction.

Reduction – the addition of hydrogen, removal of oxygen or addition of electrons to an element or compound. Under anaerobic conditions in wastewater, sulfur or compounds elemental sulfur are reduced to H_2S or sulfide ions.

This course contains general EPA's CWA federal rule requirements. Please be aware that each state implements wastewater/safety/environment regulations that may be more stringent than EPA's regulations. Check with your state environmental agency for more information.

1.5.1 Prohibited Discharge Standards *(Credit USEPA)*

Prohibited discharge standards are somewhat general, national standards are applicable to all industrial users to a POTW, regardless of whether or not the POTW has an approved pretreatment program or the industrial user has been issued a permit.

These standards are designed to protect against pass through and interference, protect the POTW collection system, and to promote worker safety and beneficial biosolids use. These standards are listed in 40 CFR 403.5

For Final Regulations pertaining to the Pretreatment Program, refer to 40 CFR Part 403 general pretreatment regulations (Located in the rear of this course).

1.5.2 Categorical Pretreatment Standards

Categorical Pretreatment Standards are limitations on pollutant discharges to publicly owned treatment works (POTWs), promulgated by the EPA in accordance with Section 307 of the Clean Water Act that apply to specific process wastewaters of particular industrial categories.

These are national, technology-based standards that apply regardless of whether or not the POTW has an approved pretreatment program or the industrial user has been issued a permit. Such industries are called Categorical Industrial Users. The standards applicable to industrial discharges to a POTW collection system are designated in the Effluent Guidelines & Limitations [Parts 405-471] by the terms "Pretreatment Standards for Existing Sources" (or "PSES") and "Pretreatment Standards for New Sources" (or "PSNS").

Note: The Effluent Guidelines & Limitations designated by the terms "Best Practicable Control Technology Currently Available (BPT)", "Best Available Technology Economically Achievable (BAT)", "Best Conventional Pollutant Control Technology (BCT)", and "New Source Performance Standards (NSPS)" apply to industries that discharge process wastewater to waters of the U.S. and should have a National Pollutant Discharge Elimination System (NPDES) Permit.

Regulations for all Effluent Guidelines and Standards are located at: http://www.epa.gov/

Additional information on ongoing Categorical Standards Projects and recently published rules is located at: http://www.epa.gov/

Conventional Pollutants (Credit USEPA)

BOD, TSS, fecal coliform, oil and grease, and pH

In the above photo, sampling equipment after being washed and being allowed to air dry. A Pretreatment Inspector or Sampler may spend up to 1-2 hours a day preparing your sample bottles. This may include washing your sample tools, bottles and other equipment.

Some bottles will need to be washed in a three or four step process. Hydrochloric and other acids are used for the cleaning of glass bottles. The Pickle jar or large jar is often re-used and washed on a daily basis.

Pretreatment Inspectors and Stormwater Inspectors will often work in pairs. Usually one Inspector will spend much time setting up automatic samplers and programming flow meters, while the other Inspector will calibrate pH meters and related laboratory equipment, pre-preserve sample bottles, gather ice and calibrate the safety equipment and gas meters.

Some POTWs will hire both Samplers and Inspectors and split these duties up. Other POTWs will utilize Inspectors as Samplers.

1.5.2.1 Effluent Guidelines

Effluent Guidelines are national wastewater discharge standards that are developed by EPA on an industry-by-industry basis. These are technology-based regulations, and are intended to represent the greatest pollutant reductions that are economically achievable for an industry. The standards for direct dischargers are incorporated into National Pollutant Discharge Elimination System (NPDES) permits issued by States and EPA regional offices, and permits or other control mechanisms for indirect dischargers.

BPT
Best Practicable Control Technology Currently Available is defined at CWA section 304(b)(1). In specifying BPT, EPA looks at a number of factors:

- the total cost of applying the control technology in relation to the effluent reduction benefits
- age of the equipment and facilities
- processes employed by the industry and any required process changes
- engineering aspects of the control technologies
- non-water quality environmental impacts, including energy requirements
- other factors as EPA deems appropriate

Traditionally, EPA establishes BPT effluent limitations based on the average of the best performance of facilities within the industry of various ages, sizes, processes or other common characteristics. Where existing performance is uniformly inadequate, BPT may reflect higher levels of control than currently in place in an industrial category if the Agency determines that the technology can be practically applied.

BCT
Best Conventional Pollutant Control Technology, defined at CWA section 304(b)(4), addresses conventional pollutants from existing industrial point sources. In addition to considering the other factors specified in section 304(b)(4)(B), EPA establishes BCT limitations after consideration of a two part "cost-reasonableness" test. The initial BCT methodology and some BCT effluent limitations were published in 1979. A revised methodology, with additional effluent limitations, and some revised limitations, were published in 1986.

BAT
Best Available Technology Economically Achievable is defined at CWA section 304(b)(2). In general, BAT represents the best available economically achievable performance of plants in the industrial subcategory or category. Factors considered in assessing BAT include:

- cost of achieving BAT effluent reductions
- age of equipment and facilities involved
- the processes employed by the industry and potential process changes
- non-water quality environmental impacts, including energy requirements
- other factors as EPA deems appropriate

NSPS
New Source Performance Standards, defined at CWA section 306, apply to direct dischargers. NSPS reflect effluent reductions that are achievable based on the "best available demonstrated control technology." New sources have the opportunity to install the best and most efficient production processes and wastewater treatment technologies. As a result, NSPS should represent the most stringent controls attainable through the application of the best available demonstrated control technology for all pollutants (i.e., conventional, non-conventional, and

priority pollutants). In establishing NSPS, EPA is directed to take into consideration the cost of achieving the effluent reduction and any non-water quality environmental impacts and energy requirements.

- Definition of "new source" for direct dischargers: 40 CFR 122.2, 122.29

PSNS

Pretreatment Standards for New Sources is defined at CWA section 307(c). PSNS are national, uniform, technology-based standards that apply to dischargers to publicly owned treatment works (POTWs) from specific industrial categories (i.e., indirect dischargers). They are designed to prevent the discharges of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs. PSNS are to be issued at the same time as NSPS. The Agency considers the same factors in promulgating PSNS as it considers in promulgating NSPS.

New indirect dischargers have the opportunity to incorporate into their plants the best available demonstrated technologies. Users subject to PSNS are required to achieve compliance within the shortest feasible time, not to exceed 90 days from commencement of discharge.

- Definition of "new source" for indirect dischargers: 40 CFR 403.3(m)

PSES

Pretreatment Standards for Existing Sources is defined at CWA section 307(b). Like PSNS, PSES are national, uniform, technology-based standards that apply to indirect dischargers. They are designed to prevent the discharge of pollutants that pass through, interfere with, or are otherwise incompatible with the operation of POTWs.

Dischargers subject to PSES are required to comply with those standards by a specified date, typically no more than three years after the effective date of the categorical standard.

BMPs

Best Management Practices are defined as a permit condition used in place of, or in conjunction with effluent limitations, to prevent or control the discharge of pollutants. BMPs may include a schedule of activities, prohibition of practices, maintenance procedure, or other management practice.
Sections 304(e), 308(a), 402(a), and 501(a) of the CWA authorize EPA to prescribe BMPs as part of Effluent Guidelines and Standards or as part of a permit.

BMP regulations:

- Direct dischargers: 40 CFR 122.2, 40 CFR 122.44(k)
- Indirect dischargers: 40 CFR 403.3(e)

CWA section 304(e) authorizes EPA to include BMPs in Effluent Guidelines for certain toxic or hazardous pollutants for the purpose of controlling "plant site runoff, spillage or leaks, sludge or waste disposal, and drainage from raw material storage." CWA section 402(a)(1) and 40 CFR 122.44(k) also provide for BMPs to control or abate the discharge of pollutants when numeric limitations and standards are infeasible.

Levels of Control

National regulations for industrial wastewater discharges set technology-based numeric limitations for specific pollutants at several levels of control: **BPT**, **BAT**, **BCT**, **NSPS**, **PSNS** or **PSES**. Each of these terms is defined below. Effluent limitations are based on performance of specific technologies, but the regulations do not require use of a specific control technology.

Type of Sites Regulated	**BPT**	**BCT**	**BAT**	**NSPS**	**PSES**	**PSNS**
Existing Direct Dischargers	•	•	•			
New Direct Dischargers				•		
Existing Indirect Dischargers					•	
New Indirect Dischargers						•
Pollutants Regulated	**BPT**	**BCT**	**BAT**	**NSPS**	**PSES**	**PSNS**
Priority Pollutants	•		•	•	•	•
Conventional Pollutants	•	•		•		
Nonconventional Pollutants	•		•	•	•	•

Source Reduction Function
The national pretreatment program identifies specific discharge standards and requirements that apply to sources of nondomestic wastewater discharged to a POTW. By reducing or eliminating waste at the industries (“source reduction”), fewer toxic pollutants are discharged to and treated by the POTWs, providing benefits to both the POTWs and the industrial users.

Pretreatment Standard Requirements
- general and specific prohibitions,
- categorical pretreatment standards, and
- local limits.

1.5.3 Industrial Pretreatment Roles and Responsibilities

These three entities have the role and responsibility to develop and implement the national pretreatment program:

Approval Authorities
Director in an NPDES authorized state with an approved state pretreatment program, and the appropriate EPA regional administrator in a non-NPDES authorized state or NPDES state without an approved state pretreatment program.

Control Authorities
The publicly owned treatment works (POTW), for a POTW with an approved pretreatment program, or the approval authority, for a POTW without an approved pretreatment program.

Industrial Users (IUs)
A nondomestic source of indirect discharge into a POTW.

Industrial Users
An industrial user (IU) must comply with all applicable federal, state, and local pretreatment standards and requirements. Some federal requirements apply to all IUs and other requirements apply only to specific types of IUs. An IU demonstrates compliance by:

- performing self-monitoring,
- submitting reports and notifications to its control authority, and
- maintaining records of its activities.

These requirements apply to each type of IU regardless of the entity serving as the control authority. These federal requirements apply regardless of whether the IU has a control mechanism (e.g., permit or discharge authorization) from its control authority.

Industrial User Requirements (IUs)
All IUs are responsible for notifying the receiving POTW and/or control authority (if they are different entities) about the following discharges or changes to existing discharge practices:

- changes affecting potential for slug discharge (40 CFR Part 403.8(f)(2)(vi)) .
- potential problems, including slug loadings (40 CFR Part 403.12(f)).
- noncompliance and repeat sampling report (40 CFR Part 403.12(g)(2)).
- changed discharge (40 CFR Part 403.12(j)).
- changed production (for IUs with limits calculated from a production-based standard) (40 CFR Part 403.6(c)(9)).
- hazardous wastes discharge (40 CFR Part 403.12(p)). See also Hazardous Waste Reporting Requirements for Industrial Users under 40 CFR 403.12(p)&(j).
- bypass (40 CFR Part 403.17).

These notifications alert the POTW and/or control authority to discharges that can affect the collection system or treatment plant. In addition, the control authority may specifically require its IUs to:

- submit reports, as required (40 CFR Part 403.12).
- maintain records of pretreatment activities, as required (40 CFR Part 403.12(o)).

1.5.4 SIU Defined

(1) All users subject to categorical pretreatment standards under 40 CFR 403.6 and 40 CFR chapter I, subchapter N, except those designated as NSCIUs; and (2) Any other IU that discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blowdown wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry-weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the POTW on the basis that the IU has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR 403.8(f)(6)]. [40 CFR 403.3(v)]s must comply with additional requirements in the federal regulations that include, but are not limited to the following:

- Conduct required self-monitoring and submit periodic compliance reports every six months according to the reporting requirements for IUs not subject to categorical pretreatment standards (40 CFR Part 403.12(h)).
  - Ensure that self-monitoring meets applicable sample collection and analysis requirements (40 CFR Part 403.12(g)).
  - Ensure that reports meet applicable signatory and certification requirements (40 CFR Part 403.12(l)).
- Develop and implement a slug control plan, if required by the control authority (40 CFR Part 403.8(f)(2)(vi)).

SIU Additional Requirements

Because an IU can be as simple as an automated, coin-operated car wash or as complex as an automobile manufacturing plant or a synthetic chemical producer, EPA developed four criteria that define a significant industrial user (SIU):

- is subject to categorical pretreatment standards (CIUs) under 40 CFR Part 403.6 and 40 CFR chapter I, subchapter N, except those designated as NSCIUs; or
- discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blowdown wastewater); or
- contributes a process wastestream that makes up five percent or more of the average dry-weather hydraulic or organic capacity of the POTW treatment plant; or
- is designated as such by the POTW on the basis that the IU has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR Part 403.8(f)(6)]

We will go into more detail ion this subject in the next topic section.

1.5.5 CIU Responsibilities

A CIU must comply with these federal requirements regardless of whether it has a control mechanism (e.g., permit or discharge authorization) from its control authority. These reports and notifications provide the POTW and/or control authority basic information on the industrial facility and regular reports on the facility's compliance status with categorical and other applicable standards.

The CIU must notify its POTW and/or control authority (if they are different entities) about the following:

- Production level change in the equivalent limit calculation (40 CFR Part 403.6(c)(5)) .
- Material/significant change in the alternative limit calculation (40 CFR Part 403.6(e)) .
- Waived pollutant present (40 CFR Part 403.12(e)(2)(vi)).
- Middle-tiered categorical industrial user (40 CFR Part 403.12(e)(3)(iv)).

Additional Requirements for CIUS
EPA develops national standards that are based on particular industrial processes. These standards are technology-based (i.e. they are based on the performance of treatment and control technologies); they are not based on risk or impacts upon receiving waters. These standards are found at 40 CFR Part 405-471.

Non-domestic dischargers subject to these national standards are called categorical industrial users (An industrial user subject to national categorical pretreatment standards). CIUs must comply with additional requirements in the federal regulations that include, but are not limited to, the following:

- Submit to its control authority:
  - a baseline monitoring report (40 CFR Part 403.12(b)(1–7)),
  - compliance schedule progress reports (40 CFR Part 403.12(c)(1–3)),
  - a 90-day compliance report (40 CFR Part 403.12(d)), and
  - a periodic compliance report (40 CFR Part 403.12(e)) (This requirement is the CIU equivalent to the SIUs reports required at 40 CFR Part 403.12(h)).
- Notify the POTW and/or control authority of upset (40 CFR Part 403.16).

SAMPLING PLAN

Prior to laboratory analysis a sampling plan should consider the following:

1. Why is the sample being collected?
2. What tests need to be performed?
3. At what location will the sample be taken?
4. Will the sample be analyzed at the location?
5. When and how often must the sample be analyzed?
6. Is it a grab or composite sample?
7. Is it for process control or compliance?

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1.6 As a Pretreatment Inspector, you will Collect Many Samples.

Grab Samples (Snapshot)
A grab sample consists of a single container or large bucket of wastewater analyzed at one specific time. Grab samples indicate the condition of the wastewater at that specific time and may or may not represent the normal conditions. Grab samples are required when the analysis change rapidly. For instance, grab samples are required for certain tests such as temperature, pH, D.O. (dissolved oxygen), and bacteriological analysis.

Composite Samples
A composite sample consists of several grab samples collected from the same spot over a specific period of time and merged into a single sample. A composite sample is more arduous, complicated and usually inconvenient than a simple grab sample. Collecting a sample every few minutes and adding it to a single bottle is tedious, boring, and costly. To help solve this problem, a 24-hour automatic sampler is often used. The automatic sampler consists of a battery pack, a programmable timer, a pump, and as many as 24 bottles.

The automatic sampler has the capability to be programmed to draw a certain volume of sample every few minutes and deposit each sample into one bottles that are preserved or refrigerated. At the end of the sampling period, the operator can retrieve the bottles, bring them back to the lab and create a single composite sample. Analysis can now be performed on a single composite sample that is more representative of the wastewater quality than a grab sample.

Unweighted Composite
An unweighted composite collects the same sample volume at a constant time interval. For example, the operator collects 100 ml every hour for 6 hours. At the end of the time period, there will be 12 individual bottles representing the wastewater quality over the 6 hour time period. The operator now composites the samples by pouring from each bottle into a large bottle and mixes the composite.

Flow Weighted Composite
A flow meter is connected to the composite sampler and the sampler is programed to draw at different flow intervals. As the flow increases so does the number of samples. We will go into more detail ion this subject in a later topic section.

1.7 Local Limits Introduction *(Credit USEPA)*

Local limits are developed to reflect specific needs and capabilities at individual POTWs and designed to protect the POTW receiving waters. Regulations at 40 CFR 403.8(f)(4) state that POTW Pretreatment Programs must develop local limits or demonstrate that they are unnecessary; 40 CFR 403.5(c) states that local limits are needed when pollutants are received that could result in pass through or interference at the POTW. Essentially, local limits translate the general prohibited discharge standards of 40 CFR 403.5 to site-specific needs.

Assistance on how to develop local limits may be found in the Guidance Manual for the Development and Implementation of Local Discharge Limitations under the Pretreatment Program.). Information related to ordering this publication from the Office of Wastewater Management is located at: http://www.epa.gov/.

The EPA Supplemental Manual on the Development And Implementation of Local Discharge Limitations Under the Pretreatment Program: Residential and Commercial Toxic Pollutant Loadings and POTW Removal published May 1, 1991 provides information related to residential and commercial sources of toxic pollutants and estimated removal efficiencies of municipal treatment processes.

Two automatic wastewater samplers, one for Local Limits or compliance and the other for the wastewater plant operator to determine plant efficiency. We will go into more detail ion this subject in the next topic section.

1.8 Key Review Notes

CHEMICAL OXYGEN DEMAND

Oxidizable chemicals (such as reducing chemicals) introduced into a natural water will similarly initiate chemical reactions (such as shown above). Those chemical reactions create what is measured in the laboratory as the **chemical oxygen demand (COD).**

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B.O.D.

Biochemical Oxygen Demand (**BOD**, also called **Biological Oxygen Demand**) is the amount of dissolved oxygen needed (i.e. demanded) by aerobic biological organisms to break down organic material present in a given water sample at certain temperature over a specific time period. The **BOD** value is most commonly expressed in milligrams of oxygen consumed per liter of sample during 5 days of incubation at 20 °C and is often used as a surrogate of the degree of organic pollution of water.

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BOD TESTING CONCEPT

BOD test must create ideal growing conditions which will encourage microorganisms to effectively and efficiently utilize the digestible organic materials (waste). Running a **BOD analysis** on a sample consists of placing a portion of a sample (along with prepared dilution water) into an air-tight bottle (300 ml volume) and incubating the bottle at 20 +/- 1 deg C for (usually) 5 days.

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As a pretreatment inspector, you should be memorizing these terms (see above boxes). These USEPA terms are essential for any successful pretreatment inspector to communicate with the public. Most wastewater treatment operators knows these terms.

CATEGORICAL INDUSTRIAL USER

A **categorical industrial user** is an industry or entity which is subject to categorical standards. The wastewater from an entity or industry discharging into a sewer system tributary to a POTW (industrial user - IU) may be as simple and uncomplicated as that of a coin-operated car wash or as complex as an automobile manufacturing plant or a synthetic organic chemical producer. The IUs discharging complex wastewater would likely be subject to categorical standards, which is one of the defining criteria for significant industrial users.

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CATEGORICAL STANDARDS

Categorical standards are technology-based limitations on pollutant discharges to POTWs, which have been promulgated by U.S. EPA in accordance with Section 307 of the Clean Water Act, and apply to specific process wastewater discharges for thirty-two (32) different industrial categories. (Categorical standards can be found in 40 CFR Parts 405-471.) Categorical standards are similar to federal effluent guidelines (FEGs), with two important distinctions:

- **categorical standards** apply to indirect discharges while FEGs apply only to direct discharges to surface waters; and
- **categorical standards** are developed with the assumption that the POTW will remove at least small amounts of a pollutant, therefore the categorical standard for the pollutant will be less stringent than the corresponding best available technology (BAT) limits for the FEG applied to a direct discharger

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GENERAL PROHIBITIONS

The federal pretreatment regulations at 40 CFR Part 403.5(a)(1) includes **"general prohibitions"** for industrial users stating that no user shall introduce into a POTW any pollutant(s) which causes pass through or interference. The federal regulations also established specific prohibitions for users.

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DENTAL CATEGORY

EPA's Effluent Limitations Guidelines and Standards for the **Dental Category**, also known as the Dental Amalgam Rule, went into effect for new sources on July 14, 2017. New dental offices that place or remove amalgam fillings must now install and maintain dental amalgam separators, follow best **management practices (BMPs),** and submit a one-time compliance report to their POTW or other pretreatment control authority. New dental offices must submit their compliance report no later than 90 days after beginning discharge of wastewater to a POTW.

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INTERFERENCE

Interference: a discharge from an industrial user that, alone or in conjunction with other sources a) inhibits or disrupts a POTW plant, its treatment processes or operations, or its sludge processes, use, or disposal, and b) therefore causes a violation including increasing a violation's magnitude or duration of any permit or rule that controls release of pollutants from the POTW.

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LOCAL LIMITS

Delegated POTWs must control SIUs individually and not impose limits on them that may allow violations of the general or specific prohibitions. The POTW generally should impose required local limits (limits imposed by POTW to prevent interference or pass-through) for all SIUs, and is required to when interference or pass-through has occurred and may reoccur. A POTW also must evaluate **local limits** if an SIU causes interference or pass-through without violating a **local limit**. In addition to required local limits, a POTW may set other local limits not required by pretreatment rules. The State can enforce required local limits, but cannot enforce the non-required limits.

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LOADING LIMITS

In the context of an NPDES permit, a loading limit determines the amount of a pollutant (in pounds per day) which can be discharged in wastewater effluent. The loading limit is generally based upon the allowable concentration of the pollutant and a design flow rate for the discharge.

The loading limit would be calculated as follows:
loading limit = Flow million gallons/day x 8.34 lbs/gallon x Concentration mg/L

Loading limits are normally not included in indirect discharge permits, with an exception being permits for food processors.

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As a pretreatment inspector, you should be memorizing these terms (see above boxes). These USEPA terms are essential for any successful pretreatment inspector to communicate with the public.

Applicability of Pretreatment Standards and Requirements

The national pretreatment program objectives are achieved by applying and enforcing three types of pretreatment standards:

- General and specific prohibitions
- Categorical pretreatment standards
- Local limits

All three types of standards can be enforced by EPA, the state, and local government, even though they are developed at different levels of government (i.e., federal, state, and local). Pretreatment standards and requirements can be expressed as numeric limits, narrative prohibitions, and best management practices. The most effective and practical ways to control pollutants and meet environmental quality goals. BMPs exist for forestry, agriculture, stormwater and many other sectors. (BMPs The most effective and practical ways to control pollutants and meet environmental quality goals. BMPs exist for forestry, agriculture, stormwater and many other sectors.).

IUs should be aware of the standards that apply to them. The control authority, in the case of a POTW with an approved pretreatment program, or the Approval Authority, in the case of a POTW without an approved pretreatment program. [paraphrased from 40 CFR 403.3(f)] is responsible for identifying standard(s) applicable to each IU and applying the most stringent requirements where multiple provisions exist.

CATEGORICAL INDUSTRIAL USER

A **categorical industrial user** is an industry or entity which is subject to categorical standards. The wastewater from an entity or industry discharging into a sewer system tributary to a POTW (industrial user - IU) may be as simple and uncomplicated as that of a coin-operated car wash or as complex as an automobile manufacturing plant or a synthetic organic chemical producer. The IUs discharging complex wastewater would likely be subject to categorical standards, which is one of the defining criteria for significant industrial users.

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The different pretreatment standards are applied to IUs, significant industrial users (SIU (1) All users subject to categorical pretreatment standards under 40 CFR 403.6 and 40 CFR chapter I, subchapter N, except those designated as NSCIUs; and (2) Any other IU that discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blowdown wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry-weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the POTW on the basis that the IU has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement [in accordance with 40 CFR 403.8(f)(6)]. [40 CFR 403.3(v)]s), and categorical industrial users (CIUs) as follows:

	General and Specific Prohibitions	Categorical Pretreatment Standards	Local Limits
All IUs	**X**		May apply; depends on publicly owned treatment works (POTW) ordinance and permit provisions
SIUs	**X**		Generally apply; may depend on allocation method
CIUs	**X**	**X**	Generally apply; may depend on allocation method

1.9 Sewage Collection System Introduction

Publicly owned treatment works (**POTWs**) collect wastewater from homes, commercial buildings, and industrial facilities and transport it via a series of pipes, known as a collection system, to the treatment plant.

Collection systems may flow entirely by gravity, or may include lift stations that pump the wastewater via a force main to a higher elevation where the wastewater can then continue via gravity. Ultimately, the collection system delivers this sewage to the treatment plant facility. Here, the POTW removes harmful organisms and other contaminants from the sewage so it can be discharged safely into the receiving stream.

New sewer manhole with sewer mains before final burial.

Without treatment, sewage creates bad odors, contaminates water supplies, and spreads disease. Today, more than 16,000 sewage treatment plants exist in the U.S. treating more than 32 billion gallons per day of wastewater.

Modern sewer vactor or Camel. It is wise to make friends with the collection crews. The collection crews can greatly assist you in your enforcement efforts and can tell you lots of information, only if you develop a relationship with them.

Section 101 of the Clean Water Act (CWA)

To restore and maintain the chemical, physical, and biological integrity of the Nation's waters:
(1) it is the national goal that the discharge of pollutants into the navigable waters be eliminated by 1985;
(2) it is the national goal that wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife and provides for recreation in and on the water be achieved by July 1, 1983;
(3) it is the national policy that the discharge of toxic pollutants in toxic amounts be prohibited;
(4) it is the national policy that Federal financial assistance be provided to construct publicly owned waste treatment works;
(5) it is the national policy that Area wide waste treatment management planning processes be developed and implemented to assure adequate control of sources of pollutants in each State;
(6) it is the national policy that a major research and demonstration effort be made to develop technology necessary to eliminate the discharge of pollutants into the navigable waters, waters of the contiguous zone, and the oceans; and
(7) it is the national policy that programs for the control of nonpoint sources of pollution be developed and implemented in an expeditious manner so as to enable the goals of this Chapter to be met through the control of both point and nonpoint sources of pollution.

Sanitary Sewer Overflows

Sanitary Sewer Overflows (SSOs) are discharges of raw sewage from municipal sanitary sewer systems. SSOs can release untreated sewage into basements or out of manholes and onto city streets, playgrounds, and into streams before it can reach a treatment facility. SSOs are often caused by blockages and breaks in the sewer lines.

Why do Sewers Overflow?
SSOs occasionally occur in almost every sewer system, even though systems are intended to collect and contain all the sewage that flows into them. When SSOs happen frequently, it means something is wrong with the system.

Problems that Can Cause Chronic SSOs Include:

- Infiltration and Inflow (I&I): too much rainfall or snowmelt infiltrating through the ground into leaky sanitary sewers not designed to hold rainfall or to drain property, and excess water inflowing through roof drains connected to sewers, broken pipes, and badly connected sewer service lines.
- Undersized Systems: Sewers and pumps are too small to carry sewage from newly-developed subdivisions or commercial areas.
- Pipe Failures: blocked, broken or cracked pipes, tree roots grow into the sewer, sections of pipe settle or shift so that pipe joints no longer match, and sediment and other material builds up causing pipes to break or collapse.
- Equipment Failures: pump failures, power failures.
- Sewer Service Connections: discharges occur at sewer service connections to houses and other buildings; some cities estimate that as much as 60% of overflows comes from the service lines.
- Deteriorating Sewer System: improper installation, improper maintenance; widespread problems that can be expensive to fix develop over time, some municipalities have found severe problems necessitating billion-dollar correction programs, often communities have to curtail new development until problems are corrected or system capacity is increased.

Why are SSOs a Problem?
The EPA has found that SSOs caused by poor sewer collection system management pose a substantial health and environmental challenge. The response to this challenge varies considerably from state to state. Many municipalities have asked for national consistency in the way permits are considered for wastewater discharges, including SSOs, and in enforcement of the law prohibiting unpermitted discharges. In response, the EPA has convened representatives of states, municipalities, health agencies, and environmental advocacy groups to advise the Agency on how to best meet this challenge.

This SSO Federal Advisory Subcommittee examines the need for national consistency in permitting and enforcement, effective sewer operation and maintenance principles, public notification for SSOs with potential health or environmental dangers, and other public policy issues. The EPA carefully considers the Subcommittee's recommendations for regulatory and nonregulatory actions to reduce SSOs nationally.

How Big is the SSO Problem?
The total number of SSOs that occur nationwide each year is not known. In some areas, they might not be reported or are underreported to the EPA and state environmental agencies. Two surveys, however, help to define the size of the problem:

- In a 1994 survey of 79 members of the Association of Metropolitan Sewerage Agencies, 65 percent of the respondents reported wet weather SSOs. They reported that between 15 and 35 percent of their sewers were filled above capacity and/or overflowed during wet weather. However, municipal respondents with SSOs had only limited information about them. Only 60 percent had estimated the annual number. Half of those had estimated the amount of sewerage discharged, and 17 percent had determined what pollutants were in their overflows.
- A 1981 survey conducted by the National Urban Institute indicated an average of 827 backups and 143 breaks per 1,000 miles of sewer pipe (about 1,000 miles of sewer pipe are needed to serve 250,000 people.) per year. Breaks occurred most often in the young, growing cities of the South and West.

Combined Sewer Overflows

Combined sewer systems are sewers that are designed to collect rainwater runoff, domestic sewage, and industrial wastewater in the same pipe. Most of the time, combined sewer systems transport all of their wastewater to a sewage treatment plant, where it is treated and then discharged to a water body. During periods of heavy rainfall or snowmelt, however, the wastewater volume in a combined sewer system can exceed the capacity of the sewer system or treatment plant. For this reason, combined sewer systems are designed to overflow occasionally and discharge excess wastewater directly to nearby streams, rivers, or other water bodies.

These overflows, called combined sewer overflows (CSOs), contain not only storm water but also untreated human and industrial waste, toxic materials, and debris. They are a major water pollution concern for the approximately 772 cities in the U.S. that have combined sewer systems. CSOs may be thought of as a type of "urban wet weather" discharge. This means that, like sanitary sewer overflows (SSOs) and storm water discharges, they are discharges from a municipality's wastewater conveyance infrastructure that are caused by precipitation events such as rainfall or heavy snowmelt.

The EPA's CSO Control Policy, published April 19, 1994, is the national framework for control of CSOs. The Policy provides guidance on how communities with combined sewer systems can meet Clean Water Act goals in as flexible and cost-effective a manner as possible. EPA's Report to Congress on implementation of the CSO Control Policy assesses the progress made by EPA, states, and municipalities in implementing and enforcing the CSO Control Policy.

The Elements of a Proper CMOM Program

Utility Specific
The complexity and expense associated with a utility's CMOM or MOM programs is specific to the size and complexity of the Publicly Owned Treatment Works (POTW) and related infrastructure. Factors such as population growth rate and soil/groundwater conditions also dictate the level of investment which should be made.

Purposeful
When MOM programs are present and properly maintained, they support customer service and protect system assets, public health, and water quality.

Goal-Oriented
Proper MOM programs have goals directed toward their individual purposes. Progress toward these goals is measurable, and the goals are attainable.

Uses Performance Measures
Performance measures should be established for each MOM program in conjunction with the program goal. These measures are quantifiable, and used in determining progress to, or beyond, the program goal.

Periodically Evaluated
An evaluation of the progress toward reaching the goals, or a reassessment of the goals, should be made periodically and based upon the quantified performance measures.

Available In Writing
The effectiveness of a MOM program quickly breaks down unless it is available in writing. Personnel turnover and lapses in communication between staff and management can change otherwise proper MOM programs to improper ones. Written MOM programs are useful only if they are made readily available to all personnel and clearly documented.

Implemented by Trained Personnel
Appropriate safety, equipment, technical, and program training is essential for implementing MOM programs properly.

What MOM programs should be audited?
MOM activity at a utility involves its entire wastewater infrastructure. Common utility management activities and operations and maintenance activities associated with sewer systems and pretreatment are listed in the Self-Audit Review Document.

If a utility owns treatment works or a pond system, then activities associated with the management, operation, and maintenance of these facilities should also be included in the audit. A helpful guide for this part is the NPDES Compliance Inspection Manual. Instruction for obtaining this manual is provided in a list of references.

What are the elements of a proper Self-Audit?
Initial Assessment
Begin by performing a general assessment of the utility, and prioritizing the order of programs to be audited. The NPDES Compliance Inspection Manual and Guidance may be useful references in making this assessment.

Develop the Audit Plan
Identify the MOM programs present and/or needed at the utility, establish performance measures, and develop a schedule for auditing the programs.

Conduct the Audit
Evaluate each MOM program against the defined elements of a proper program. This can be accomplished by reviewing the program's records and resources, conducting a field evaluation, and comparing the program understanding of both personnel and management.

Identify Deficiencies
Define any programs needed, or improvements to programs needed, and any infrastructure deficiencies found. Identify any unpermitted discharges which have occurred in the past five years.

Develop Improvement Plan
Define the utility's plan/schedule to remediate the necessary improvements. This plan should include any short-term or long-term program improvements, and any short-term or long-term capital improvements which need addressing.

Prepare the Self-Audit Report
Generate a report of the audit results, including any deficiencies found and the corresponding improvement plan, which is useful for the utility. This report should be capable of serving the utility as a reference when conducting any needed remedial measures, and as a reference to compare current performance with future self-audit results.

Are there federal grants or other compliance assistance resources available to conduct a Self-Audit?
Currently, there are no funds available for the specific purpose of conducting a MOM Programs Self-Audit. However, the Office of Wastewater Management offers a number of financial resources to assist qualified utilities in making improvements to their programs.

Small publicly-owned wastewater treatment plants which discharge less than 5 million gallons per day are also eligible for the Wastewater Treatment Plant Operator On-Site Assistance Training Program. The program provides on-site operator training, financial management, troubleshooting, and other operation and maintenance assistance.

A network of operator training personnel, EPA Regional Office Coordinators and States and State Training Centers work in the field with small under-served communities to help solve their operation and maintenance problems. There is no cost incurred by the facility in need of assistance. The only requirement of the program is the willingness to work with a trainer to correct the facility's problems.

What Health Risks do SSOs present?
Because SSOs contain raw sewage they can carry bacteria, viruses, protozoa (parasitic organisms), helminths (intestinal worms), and borroughs (inhaled molds and fungi). The diseases they may cause range in severity from mild gastroenteritis (causing stomach cramps and diarrhea) to life-threatening ailments such as cholera, dysentery, infectious hepatitis, and severe gastroenteritis.

People can be Exposed Through:

- Sewage in drinking water sources.
- Direct contact in areas of high public access such as basements, lawns or streets, or waters used for recreation. At least one study has estimated a direct relationship between gastrointestinal illness contracted while swimming and bacteria levels in the water.
- Shellfish harvested from areas contaminated by raw sewage. One study indicates that an average of nearly 700 cases of illness per year were reported in the 1980s from eating shellfish contaminated by sewage and other sources. The number of unreported cases is estimated to be 20 times that.
- Some cases of disease contracted through inhalation and skin absorption have also been documented.

What other Damage can SSOs do?

SSOs also damage property and the environment. When basements flood, the damaged area must be thoroughly cleaned and disinfected to reduce the risk of disease. Cleanup can be expensive for homeowners and municipalities. Rugs, curtains, flooring, wallboard panels, and upholstered furniture usually must be replaced. A key concern with SSOs that enter oceans, bays, estuaries, rivers, lakes, streams, or brackish waters is their effect on water quality. When bodies of water cannot be used for drinking water, fishing, or recreation, society experiences an economic loss. Tourism and waterfront home values may fall. Fishing and shellfish harvesting may be restricted or halted. SSOs can also close beaches. One 1994 study claims that SSOs closed beaches across the nation that year for a total of more than 300 days.

How can SSOs be Reduced or Eliminated?

Many avoidable SSOs are caused by inadequate or negligent operation or maintenance, inadequate system capacity, and improper system design and construction. These SSOs can be reduced or eliminated by:

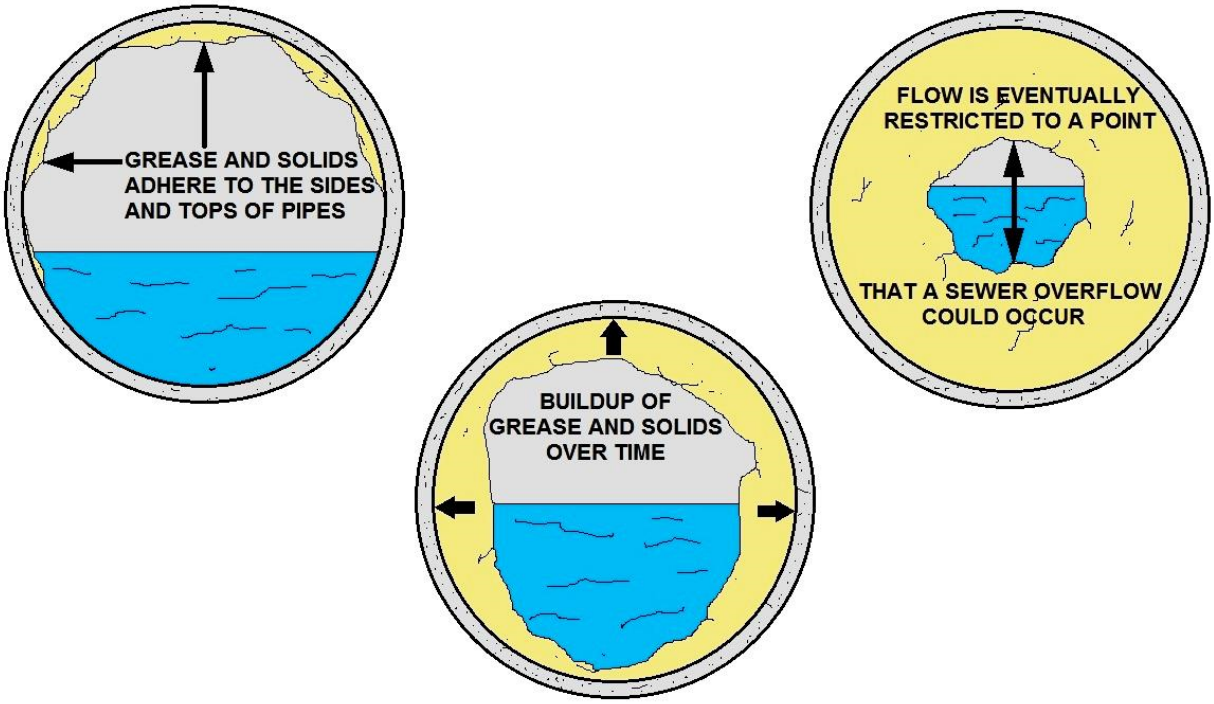
- Sewer system cleaning and maintenance.
- Reducing infiltration and inflow through system rehabilitation and repairing broken or leaking service lines.
- Enlarging or upgrading sewer, pump station, or sewage treatment plant capacity and/or reliability.
- Construction of wet weather storage and treatment facilities to treat excess flows.

Communities also should address SSOs during sewer system master planning and facilities planning, or while extending the sewer system into previously unsewered areas.

A few SSOs may be unavoidable. Unavoidable SSOs include those occurring from unpreventable vandalism, some types of blockages, extreme rainstorms, and acts of nature such as earthquakes or floods.

What Costs are Involved with Reducing or Eliminating SSOs?

Sanitary sewer collection systems are a valuable part of the nation's infrastructure. The EPA estimates that our nation's sewers are worth a total of more than $1 trillion. The collection system of a single large municipality is an asset worth billions of dollars and that of a smaller city could cost many millions to replace. Sewer rehabilitation to reduce or eliminate SSOs can be expensive, but the cost must be weighed against the value of the collection system asset and the added costs if this asset is allowed to further deteriorate. Ongoing maintenance and rehabilitation adds value to the original investment by maintaining the system's capacity and extending its life.



EFFECTS OF GREASE AND SOLIDS ON SEWER FLOW

Using Best Management Practices Can:

- Lessen the likelihood of losing revenue to emergency shutdowns caused by sewage backups and expensive bills for plumbing and property repairs.
- Lessen the likelihood of lawsuits by nearby businesses over sewer problems caused by your negligence.
- Lessen the likelihood of lawsuits from workers or the public exposed to raw sewage during a backup.
- Reduce the number of times you have to pump and clean your grease interceptors or traps.
- Lessen the likelihood of surcharges from your local sewer authority, or chargebacks for repairs to sewer pipes attributable to your FOG.
- Reduce testing requirements imposed due to a history of violations.
- Lessen the likelihood of enforcement action by local authorities due to violations of ordinances.

CMOM will Require Facilities to:

- Establish general performance standards.
- Have a management program.
- Create an overflow response plan.
- Ensure system evaluations.
- Verify capacity assurance.
- Submit to periodic audits of the CMOM program.
- Notify the public and regulatory agencies of SSOs.

General Performance Standards
A CMOM program will ensure:

- There is enough capacity to handle base and peek flows.
- The use of all reasonable measure to stop SSOs.
- Proper collection, management, operation and maintenance of the system.
- Prompt notification of all parties that may be exposed to an SSO.

Management Programs
Management program documents must include:

- The goals of the CMOM program (may differ depending on the facility.)
- Legal authorities that will help implement CMOM.
- The "chain of command" for implementing CMOM and reporting SSOs.
- Design and performance requirements.
- Measures that will be taken to help implement CMOM.
- Monitoring/performance measures to how effective the CMOM program is.
- Communication plan.

Overflow Response Plan
The overflow response plan should be designed provide a quick response to SSOs. Rapid response to an SSO can mitigate structural damage, pollution of waterways, and the public health risk. The plan must include the following:

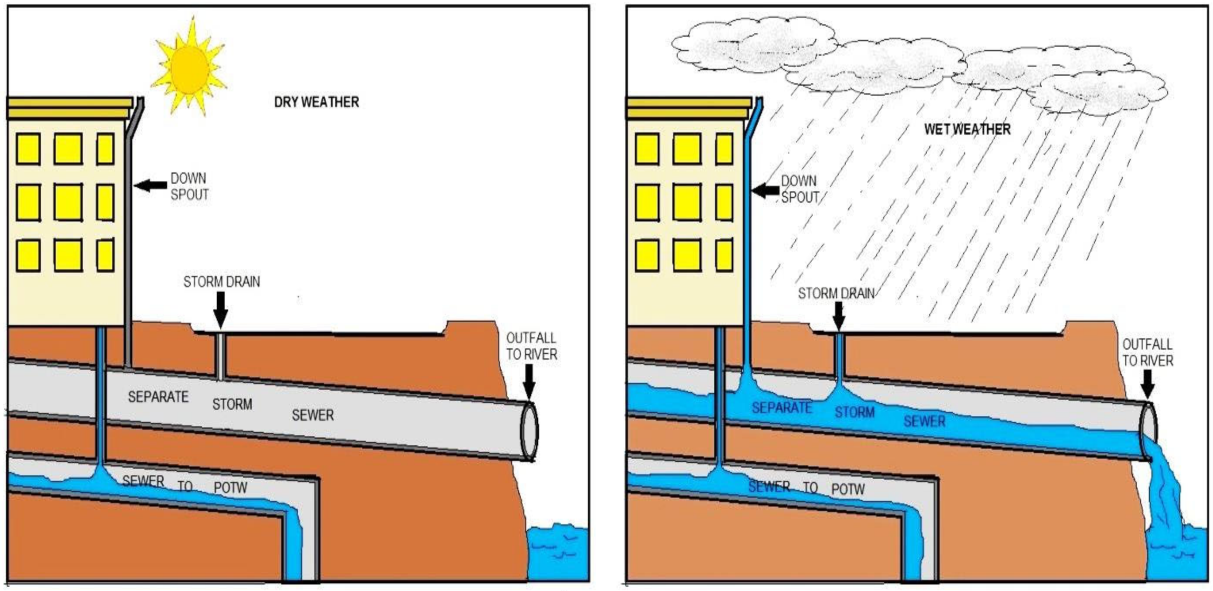
- SSO response procedures.
- Immediate notification of health officials.
- Public notification.
- Plan made available to the public.
- Distribution to all appropriate personnel.
- Revision and maintenance of the plan by appropriate personnel.

System Evaluation and Capacity Assurance Plan
These two activities work hand-in-hand to detect and address deficiencies and scheduling. These will provide:

- An evaluation of parts of the collection system that have substandard performance.
- Capacity assurance measures to address substandard performance.
- Explanation of prioritization and scheduling.

Performance measures and indicators are important in evaluating collection system performance and implementing capacity management, operation and maintenance programs.

Possible performance measures and indicators for sanitary sewer collection systems are shown below:



Storm Drain Diagram

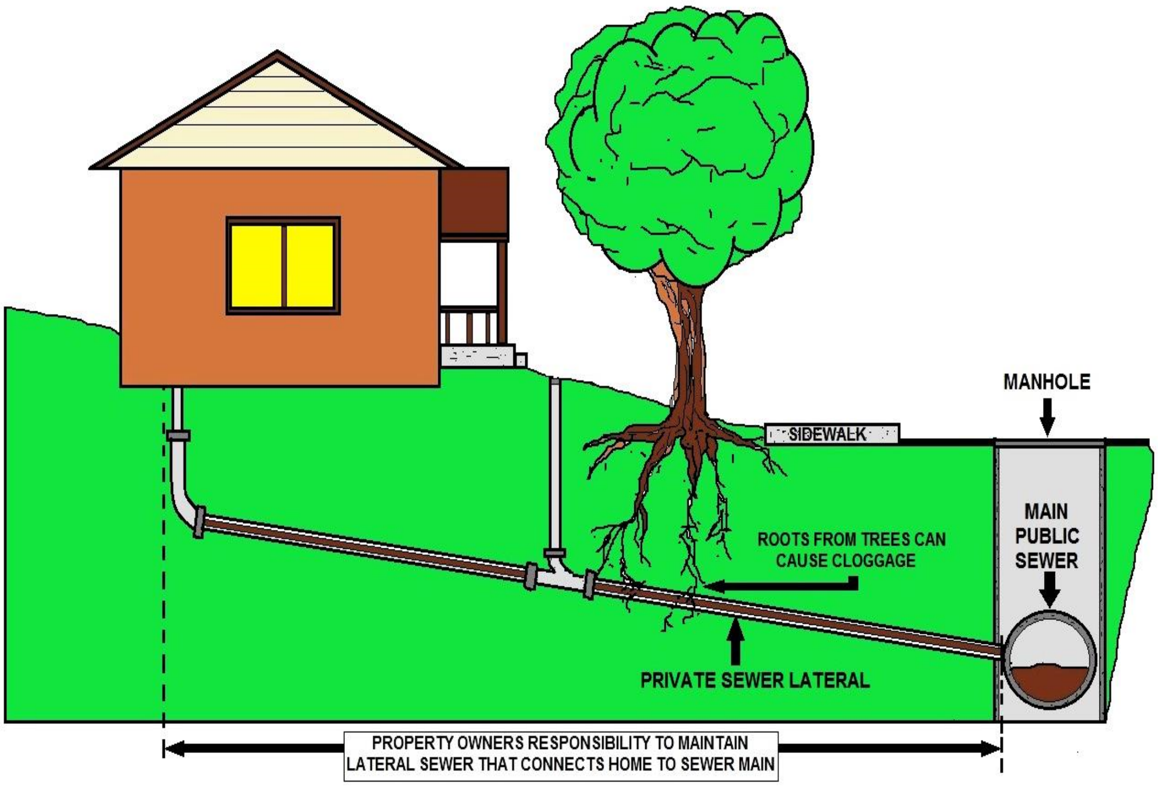


DIAGRAM OF SEWER LATERAL

Potential Performance Indicators

Input measures	Per capita costs Number of employee hours
Output measures	Length of pipe maintained Number of service calls completed Percentage of length maintained repaired this year Percentage of length maintained needing repair Length of new sewer constructed Number of new services connected
Outcomes	Number of stoppages per 100 miles of pipe Average service response time Number of complaints
Ecological/Human health/ Resource use	Shellfish bed closures Benthic Organism index Biological diversity index Beach closures Recreational activities Commercial activities

CMOM Audits
CMOM will require regular, comprehensive audits, done by each facility. These audits will help identify non-conformance to CMOM regulations so problems can be addressed quickly. All findings, proposed corrective actions and upcoming improvements should be documented in the audit report.

Communication/Notification
If an SSO occurs, sanitary sewer facilities will be required to immediately notify the NPDES permit authority, appropriate health agencies, state authorities, drinking water suppliers, and, if necessary, the general public in the risk area. This rule will also require an annual report of all overflows, including minor SSOs such as building backups. Facilities must post locations of recurrent SSOs and let the public know that the annual report is available to them. The record keeping provisions mandate that facilities must maintain records for three years about all overflows, complaints, work orders on the system, and implementation measures.

According to the EPA, an effective CMOM program would help NPDES permitees to:

- Develop/revise routine preventive maintenance activities that prevent service interruption and protect capital investments.
- Create an inspection schedule and respond to the inspection results.
- Investigate the causes of SSOs and take corrective measures.
- Respond quickly to SSOs to minimize impacts to human health and the environment.
- Identify and evaluate SSO trends.
- Develop budgets and identify staffing needs.
- Plan for future growth to ensure adequate capacity is available when it’s needed.
- Identify hydraulic (capacity) and physical deficiencies and prioritize responses, including capital investments.
- Identify and develop appropriate responses to program deficiencies (e.g., lack of legal authority, inadequate funding, and inadequate preventive maintenance).
- Keep parts and tools inventories updated and equipment in working order.

Implementation
The EPA estimates that implementing this rule will impose an additional $93.5 to $126.5 million every year on municipalities (includes planning and permitting costs). A system serving 7,500 people may need to spend an average of $6,000 every year to comply with the rule.

CMOM regulations will be added to the permit when facilities need to have a permit re-issued. Although a compliance deadline has not been set, the EPA recommends that facilities begin to implement "SSO Standard Conditions" right after the proposed rule is published. Considering the time and costs associated with compliance, this may be good advice.

Proposed Deadlines for CMOM Documentation After Permit Issuance

Avg. Daily Flow	Summary of CMOM program	Overflow Emergency Response Plan	Completion of Program Audit Report	Submission of Program Audit Report	System Evaluation and Capacity Assurance Plan
>=5 mgd	Within 18 mos.	Within 1 year	Within 18 mos.	Within 18 mos.	Initial sub-basins: 3 yrs.; All sub-basins: 5 yrs.
>1 but <5 mgd	Within 2 yrs	Within 1 yr.	Within 2 yrs.	With permit renewal application	Initial sub-basins: 3 yrs.; All sub-basins: 5 yrs.
<= 1 mgd	Within 3.5 yrs.	Within 1 yr.	Within 3.5 yrs.	With permit renewal application	Within 5 yrs.

Continuous Training
Procedures for emergency response plans should be understood and practiced by all personnel in order to ensure safety of the public and the collection system personnel responding. Procedures should be specific to the type of emergency that could occur. It is important to keep detailed records of all past emergencies in order to constantly improve response training, as well as the method and timing of future responses. The ability to deal with emergencies depends on the knowledge and skill of the responding crews, in addition to availability of equipment. The crew should be able to rapidly diagnose problems in the field under stress and select the right equipment needed to correct the problem. If resources are limited, consideration should be given to contracting other departments or private industries to respond to some emergency situations, for example, those rare emergencies that would exceed the capacity of staff.

Routine Preventative O&M Activities – Wastewater Collection Lines
Routine preventative operations and maintenance activities for wastewater collection lines shall be performed by the system's personnel and outside contractors. A qualified outside contractor can also be utilized to perform hydraulic cleaning using a jet hydro-vac combination truck and mechanical cleaning using a rodding machine. Routine operations and maintenance activities including cleaning and removing roots from small and large diameter lines. The system's goal should be a minimum of cleaning between 20-30% of the sewers every year.

1.10 FOG Introduction

Keeping Fats, Oils, and Grease out of the Sewer System
Fats, oils, and grease—FOG—comes from meat fats in food scraps, cooking oil, shortening, lard, butter and margarine, gravy, and food products such as mayonnaise, salad dressings, and sour cream.

FOG poured down kitchen drains accumulates inside sewer pipes and cause damage to the collection system. As the FOG builds up, it restricts the flow in the pipe and can cause untreated wastewater to back up into homes and businesses, resulting in high costs for cleanup and restoration.

Manholes can overflow into parks, yards, streets, and storm drains, allowing FOG to contaminate local waters, including drinking water. Exposure to untreated wastewater is a public-health hazard and is an EPA violation. FOG discharged into septic systems and drain fields can cause malfunctions, resulting in more frequent tank pump-outs and other expenses.

Restaurants, cafeterias, and fast food establishments spend tens of thousands of dollars on plumbing emergencies each year to deal with grease blockages and pump out grease traps and interceptors. Some cities also charge businesses for the repair of sewer pipes and spill cleanup if they can attribute the blockage to a particular business.

Some cities also add a surcharge to wastewater bills if a business exceeds a specified discharge limit. These expenses can be a significant.

Communities spend billions of dollars every year unplugging or replacing grease-blocked pipes, repairing pump stations, and cleaning up costly and illegal wastewater spills.

Excessive FOG in the sewer system can affect local wastewater rates. Therefore, keeping FOG out of the sewer system helps everyone in the community.

Controlling Fats, Oils, and Grease Discharges from Food Service Establishments
FOG gets into our sewer collection system mainly from residential customers pouring the substances down their drains and from commercial food preparation establishments with inadequate grease controls. Fats, oils and grease are a byproduct of cooking and are mostly found in the following:

- ✓ Meats
- ✓ Cooking oil
- ✓ Lard or shortening
- ✓ Butter or margarine

Our sewer system is not designed to handle or treat these substances in excess. Over time, without proper disposal of fats, oils and grease, they build up in the sewer system and eventually block collection pipes and sewer lines, resulting in sewer backups and overflows on streets, properties and even in customers' homes and/or businesses. Overflows may also impact the environment negatively and can result in contamination of ponds, streams or rivers.

Food Service Establishments (FSEs)
Food Service Establishments (FSEs) are a significant source of fats, oil and grease (FOG) because of the amount of grease used in cooking. POTW Commercial FOG Programs are generally developed to assist restaurants and other FSEs with proper handling and disposal of their FOG. Through implementation of Best Management Practices (BMPs), these establishments should be able to significantly reduce the amount of FOG that goes down their drains. This will minimize back-ups and help business owners comply with the POTW's requirements.

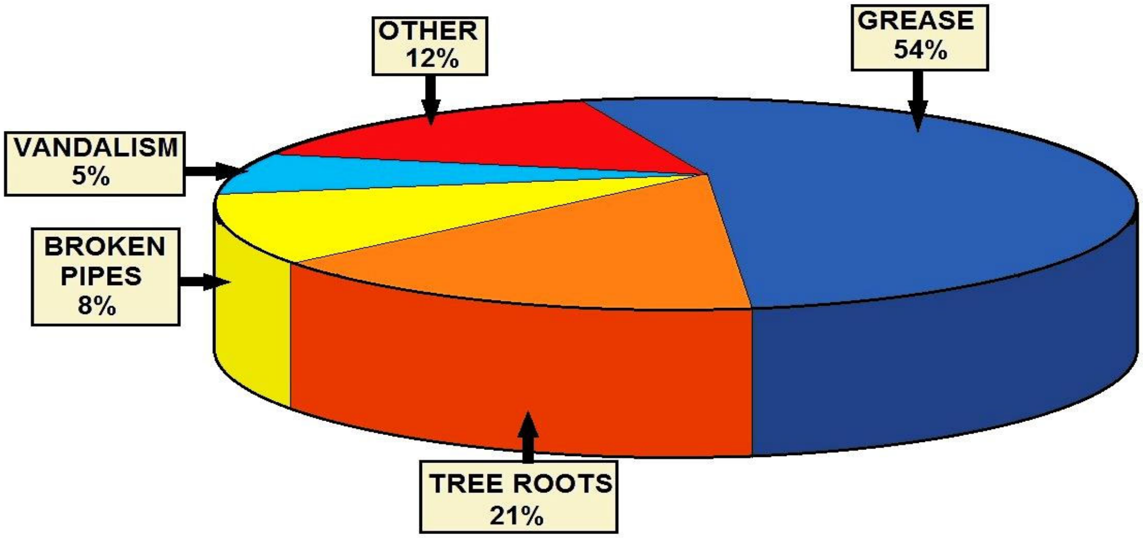
To work effectively, sewer systems need to be properly maintained, from the drain to the treatment plant. If wastes are disposed of correctly, the POTW's sewer system can handle them without any problem. Grease is an example of a waste that the sewer system cannot handle, and therefore should not be put down the drain.

The POTW needs businesses and individuals to do their part to maintain the system because repeated repairs are disruptive to residences and businesses alike. Furthermore, proper disposal by commercial establishments is required by law.

Environmental Problem with FOG Sewers
FOG that enters the sewer system eventually solidifies and forms grease balls. These grease balls can range in size from marbles to the size of cantaloupes and must be removed periodically. Since the sewer system is unable to handle or treat these substances effectively, this incurs greater expenditures on the maintenance of the collection systems and/or treatment plants which in turn can lead to higher customer rates.

Sewer backups can also cost customers thousands of dollars for the repair or replacement of their damaged property.

1.11 Controlling FOG Discharges



CAUSES OF SANITARY SEWER OVERFLOWS

FOG wastes are generated at FSEs as byproducts from food preparation activities. FOG captured on-site is generally classified into two broad categories: yellow grease and grease trap waste. Yellow grease is derived from used cooking oil and waste greases that are separated and collected at the point of use by the food service establishment.

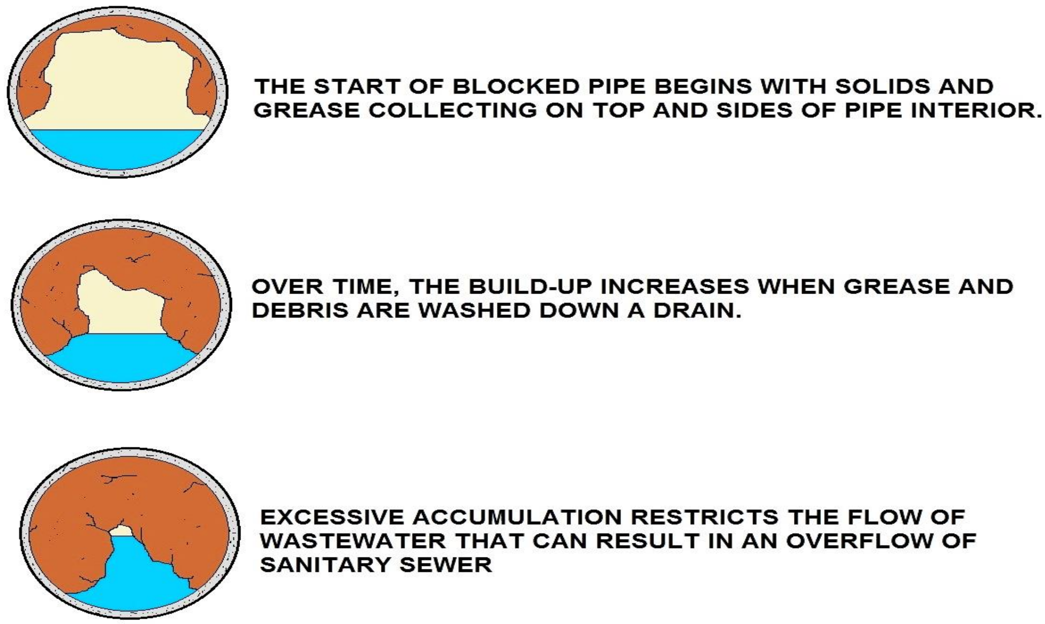
The annual production of collected grease trap waste and uncollected grease entering sewage treatment plants can be significant and ranges from 800 to 17,000 pounds/year per restaurant.

The National Pretreatment Program already provides the necessary regulatory tools and authority to local pretreatment programs for controlling interference problems. Under the provisions of Part 403.5(c)(1) & (2), in defined circumstances, a POTW must establish specific local limits for industrial users to guard against interference with the operation of the municipal treatment works.

Consequently, pretreatment oversight programs should include activities designed to identify and control sources of potential interference and, in the event of actual interference, enforcement against the violator.

Food service establishments can adopt a variety of best management practices or install interceptor/collector devices to control and capture the FOG material before discharge to the collection system. For example, instead of discharging yellow grease to POTWs, food service establishments usually accumulate this material for pick up by consolidation service companies for re-sale or re-use in the manufacture of tallow, animal feed supplements, bio-fuels, or other products.

Additionally, food service establishments can install interceptor/collector devices (e.g., grease traps) in order to accumulate grease on-site and prevent it from entering the POTW collection system.



HOW SEWER BLOCKAGE FORMS

POTWs control methods for FOG discharges from FSEs
Proper design, installation, and maintenance procedures are critical for these devices to control and capture the FOG.

For example,

- ✓ Interceptor/collector devices must be designed and sized appropriately to allow FOG to cool and separate in a non-turbulent environment.
- ✓ FSE must be diligent in having their interceptor/ collector devices serviced at regular intervals.

Best Management Practices (BMPs)
The required maintenance frequency for interceptor/collector devices depends greatly on the amount of FOG a facility generates as well as any best management practices (BMPs) that the establishment implements to reduce the FOG discharged into its sanitary sewer system. In many cases, an establishment that implements BMPs will realize financial benefit through a reduction in their required grease interceptor and trap maintenance frequency.

A growing number of control authorities are using their existing authority (e.g., general pretreatment standards in Part 403 or local authority) to establish and enforce more FOG regulatory controls (e.g., numeric pretreatment limits, best management practices including the use of interceptor/collector devices) for food service establishments to reduce interferences with POTW operations (e.g., blockages from fats, oils, and greases discharges, POTW treatment interference from Nocardia filamentous foaming, damage to collection system from hydrogen sulfide generation).

BEST MANAGEMENT PRACTICES

Background
The definition of Significant Industrial User (SIU) was added to the General Pretreatment Regulation, *40 CFR § 403* on July 24, 1990 and became effective 30 days later. This definition states that;

(1) Except as provided in paragraph (t)(2) of this section, the term Significant Industrial User means:

(i) All industrial users subject to Categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Chapter I, Subchapter N; and

(ii) Any other industrial user that: discharges an average of 25,000 gallons per day or more of process wastewater to the POTW (excluding sanitary, noncontact cooling and boiler blowdown wastewater); contributes a process wastestream which makes up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority as defined in 40 CFR 403.12(a) on the basis that the industrial user has a reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement (in accordance with 40 CFR 403.8(f)(6)).

(2) Upon a finding that an industrial user meeting the criteria in paragraph (t)(1)(ii) of this section has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the Control Authority (as defined in 40 CFR 403.12(a)) may at any time, on its own initiative or in response to a petition received from an industrial user or POTW, and in accordance with 40 CFR 403.8(f)(6), determine that such industrial user is not a significant industrial user.

As stated in (1) (ii), above, any other industrial user that has a reasonable potential for violating a pretreatment standard or requirement should be designated as an SIU by the Control Authority, either as per the potential to violate pretreatment standards or by a determination of the potential to cause an adverse effect.

With the implementation of more stringent water quality based effluent limits many municipalities are confronted with the need to include small volume/quantity industrial users in the community of regulated users. This is most apparent when the Publicly Owned Treatment Works (POTW) develops Technically Based Local Limits (TBLLs) and determines the background or unregulated contribution exceeds or approaches the Maximum Allowable Headworks Loading (MAHL).

In these situations, the POTW has little choice but to expand the universe of regulated users and begin to address small volume/quantity dischargers, usually grouped by pollutants discharged or by activity. The problem arises when the POTW determines that these small volume/quantity dischargers are a substantial contribution of the target pollutant and controls are necessary to meet NPDES permit limitations or to allow the establishment of equitable TBLLs for the larger volume dischargers.

Typically the small volume/quantity dischargers include; photodevelopers, printing and publishing facilities and medical facilities for silver; radiator and maintenance shops for lead, copper, zinc and cadmium; septic waste haulers for a multitude of pollutants; etc.

Most POTWs are concerned about the reasonableness of issuing permits and expecting these small volume/quantity dischargers to purchase and maintain the pretreatment equipment necessary to comply with TBLLs.

To avoid an adverse situation many POTWs are developing and implementing Best Management Practices (BMPs) for these facilities; the rationale being that the control and reduction of the target pollutant at many facilities will have a significant impact on the total contribution through the sheer number of facilities involved. This scenario is similar to that implemented in Palo Alto, California for silver reduction.

ACTION

The region must therefore establish guidelines, where a POTW determines it is necessary to regulate traditionally non-significant users, to allow for the implementation of BMPs and also demonstrate compliance with the General Pretreatment Regulations. To accomplish this goal the following **minimum** procedures are proposed:

* All small volume/quantity users within the specified grouping must either be regulated by the BMP guidelines or be permitted.

* Small volume/quantity users that are permitted are expected to comply with all of the pretreatment regulations pertaining to large volume and categorical SIUs.

* A list of small volume/quantity users being regulated under the BMP guidelines shall be maintained by the Control Authority and the Control Authority shall issue Letters of Authorization to each facility indicating the facilities intent to comply with the BMP guidelines.

* The Control Authority must require at least annual reporting by the small volume/quantity users, demonstrating compliance with the BMP guidelines, such as copies of maintenance records for silver recovery equipment or manifests/receipts for septic waste haulers

* The BMP guidelines must be incorporated into the Approved Pretreatment Program and established as a pretreatment standard/requirement in an ordinance, thus allowing the intent of the SIU definition to be met (however the BMP regulated users shall not be considered significant industrial users).

* The POTW must conduct inspections to determine independent of the information supplied by the industrial user compliance with the pretreatment standards. These inspections could be a reduced number from the entire universe, such as a percentage of facilities regulated by the guidelines (the facilities inspected need to change year to year to eventually allow for full coverage). We will go into more detail ion this subject in the next topic section.

1.12 Industrial Uses (Fats, Oils, and Grease)

Fats, Oils, and Grease Resources

Liquid fats and solid meat products are materials that should not be sent to landfills or disposed of in the sanitary sewer system. Fats, oils, and grease (FOG) can clog pipes and pumps both in the public sewer lines as well as in wastewater treatment facilities. This prevents combined sewer overflows, which protects water quality and lowers bills. FOG should be sent to the rendering industry to be made into another product, converted to biofuels, or sent to an anaerobic digester.

Proper Disposal Methods

Ways in which you as a customer can reduce the amounts of FOG that enters the sewer system is by doing the following:

- ✓ Have grease interceptors or traps inspected, maintained and cleaned regularly. (Usually every 6 months they should be pumped out).
- ✓ Scrape grease and food residue from dishes and pans into a garbage bag before placing them into your dishwasher or sink.

- ✓ Allow grease to cool to a safe temperature after cooking before disposal.
- ✓ Only dispose of fat and grease in an approved container or by an approved method.
- ✓ Recycle used cooking or motor oil at a recycling center.
- ✓ First freeze the grease or oil and then throw the hardened oil away on trash day.
- ✓ Mix oils with unscented kitty litter, sawdust or sand to solidify the oil (Avoid scented or disinfectant types of kitty litter as they can react with the oil and cause a fire).
- ✓ Use a paper towel to wipe small amounts of cooking oil, such as meat drippings, and throw the paper towel in the trash.
- ✓ Install “No Grease” signs around sinks to remind employees to avoid dumping fry grease and other fat products down the drain.
- ✓ Frying oils can generally be stored for up to six months and also can be reused for up to six hours of frying time. Store oil in the original container after cooling and strain for foreign materials as it is being poured back into the container.

Methods that Should be Avoided:

- ✓ Pouring household grease into sinks, garbage disposals or other drains. This is one of the major contributors to sewer stoppages.
- ✓ Flushing grease, diapers, sanitary napkins, newspapers, soiled rags, and/or paper towels down toilets.
- ✓ Pouring oil or grease into a storm drain; it is the same as pouring it directly into a lake.
- ✓ Ignoring your grease trap maintenance schedule.

1.13 Discharge to POTW *(Credit to USEPA)*

As noted above, POTWs are not designed to treat toxics in industrial waste. As such, these discharges, from both industrial and commercial sources, can cause serious problems. The undesirable outcome of these discharges can be prevented using treatment techniques or management practices to reduce or eliminate the discharge of these contaminants. The act of treating wastewater prior to discharge to a POTW is commonly referred to as "**pretreatment**." The National Pretreatment Program, published in **Title 40 Code of Federal Regulations (CFR) Part 403**, provides the regulatory basis to require non-domestic dischargers to comply with pretreatment standards (effluent limitations) to ensure that the goals of the CWA are attained.

As noted in 40CFR §403.2, the objectives of the National Pretreatment Program are to:
a. Prevent the introduction of pollutants into POTWs which will interfere with the operation of a POTW, including interference with its use or disposal of municipal sludge;
b. Prevent the introduction of pollutants into POTWs which will pass through the treatment works or otherwise be incompatible with such works; and
c. Improve opportunities to recycle and reclaim municipal and industrial wastewaters and sludges.

The two key terms used in the EPA's objectives for the National Pretreatment Program, "***interference***" and "***pass through***," are defined below.

Definitions
Interference - a discharge which, alone or in conjunction with a discharge or discharges from other sources, both inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal, and- therefore is a cause of a violation of any NPDES permit requirement or of the prevention of sewage sludge use or disposal in compliance with any applicable requirements.

Pass Through - a discharge which exits the POTW into waters of the U.S. in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any NPDES permit requirement.

As outlined in the EPA's objectives, toxic pollutants may pass through the treatment plant into the receiving stream, posing serious threats to aquatic life, to human recreation, and to consumption of fish and shellfish from these waters. Pass through can make waters unswimmable or unfishable in direct contrast to the goals of the CWA. Or, these discharges can interfere with the biological activity of the treatment plant causing sewage to pass through the treatment plant untreated or inadequately treated.

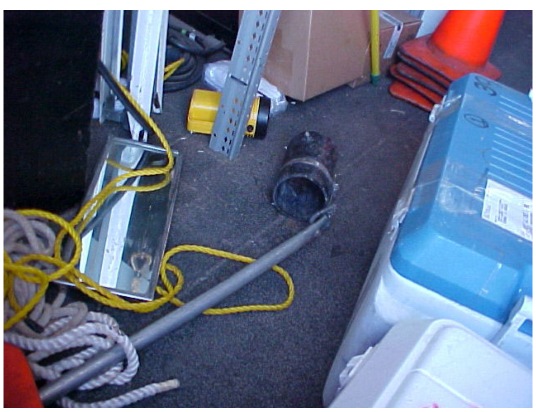
Problems Associated With Toxic Discharges *Figure 1.14*

Air pollution can occur from volatilization of toxic chemicals in the POTW collection system or treatment plant, or through incineration of sewage sludge.
Corrosion of collection system and treatment plant from acidic discharges or discharges containing elevated levels of sulfate (forming toxic and corrosive hydrogen sulfide).
Groundwater pollution can occur from leaks in the collection system or pollutants from contaminated sewage sludge.

1.14 Toxic Emissions Introduction *(Credit to USEPA)*

Even where the POTW has the capability to remove these toxics, the pollutants may end up in the sewage sludge, thereby limiting sludge disposal options or escalating the cost of disposal. Incinerated contaminated sludge may release toxic emissions into the atmosphere. Toxic metals removed in primary treatment, while itself not an inhibitory process, can impact sludge digestion, a process that utilizes bacteria to stabilize sludge solids.

For example, chromium can inhibit reproduction of aerobic digestion microorganisms, thereby disrupting sludge treatment and producing sludges that must be disposed of with special treatment. Uncontaminated sludge, on the other hand, can be used as fertilizer or soil conditioner, thereby improving the productivity of our land. Many municipalities apply sewage sludge to pastureland or parkland that they could not do if the sludge were contaminated.



Tools of the Trade… Above photos**,** the Refrigerated Automatic Sampler will have a Data programmer which will allow you to set the time to collect the sample or samples. This machine can also measure the amount of the sample.

These can also be used for the collection of composite samples. Sometimes you will see a pH probe with real-time reads sent to the Operator’s Command Center. A common sight on most wastewater plants and SIUs.

One big disappointment, expect sampler failures. Dead batteries, wrong sample times and over and under filling the sampler is common.

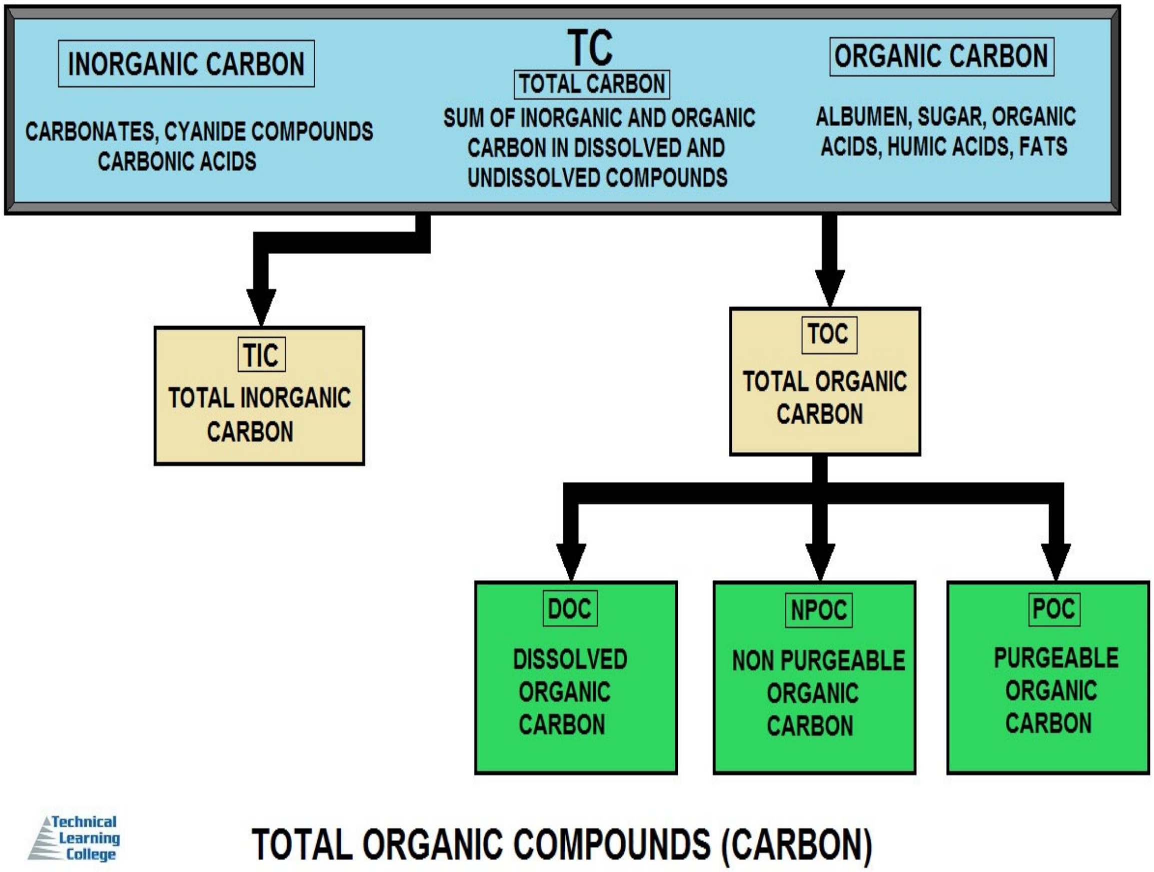
1.15 Other POTW Influencing Contaminants

Heavy Metals (Total and Dissolved)

These contaminants (priory pollutants) are bacteria-organism killers.
Heavy metals are elements from a variety of natural and human sources. Some key metals of concern and their primary sources are listed below:

- **Arsenic** from fossil fuel combustion and industrial discharges;
- **Cadmium** from corrosion of alloys and plated surfaces, electroplating wastes, and industrial discharges;
- **Chromium** from corrosion of alloys and plated surfaces, electroplating wastes, exterior paints and stains, and industrial discharges;
- **Copper** from corrosion of copper plumbing, anti-fouling paints, and electroplating wastes;
- **Lead** from leaded gasoline, batteries, exterior paints and stains;
- **Mercury** from natural erosion and industrial discharges; and
- **Zinc** from tires, galvanized metal, and exterior paints and stains.

1.16 Volatile Organic Compounds (VOCs)



One more important issues we need to address before we cover the essential of a pretreatment program is volatile organics. Volatile organics discharged to sewers can accumulate in the headspace of sewers, increasing the likelihood of explosions that can cause significant damage. Probably the most well-known impact from industrial discharges to POTWs in the U.S. is the explosion in Louisville, KY that occurred in 1981 as the result of excessive discharges of hexane into the collection system, eventually igniting and destroying more than 3 miles of sewers and causing $20 million in damage. Discharge limitations and management practices to control slug discharges have significantly reduced the likelihood of future catastrophes such as the explosion in Louisville.

Discharges of toxic organics can also result in the release of poisonous gas. This occurs most often when acidic wastes react with other wastes in the discharge. For example, cyanide and acid, both present in many electroplating operations, react to form highly toxic hydrogen cyanide gas. Similarly, sulfides from leather tanning can combine with acid to form hydrogen sulfide, another toxic gas. These can be highly dangerous to POTW collection system operators exposed to such conditions in the performance of their duties.

Other problems associated with toxic discharges were summarized in Figure 3 and further document the urgency of keeping toxics out of collection systems and POTWs.

The National Pretreatment Program is charged with controlling the 129 Priority Pollutants from industries that discharge into sewer systems as described in the CWA (see Figure A).

These pollutants fall into two categories; metals and organics:

- Metals, including lead, mercury, chromium, and cadmium that cannot be destroyed or broken down through treatment or environmental degradation. Toxic metals can cause different human health problems such as lead poisoning and cancer. Additionally, consumption of contaminated seafood and agricultural food crops has resulted in exposures exceeding recommended safe levels.

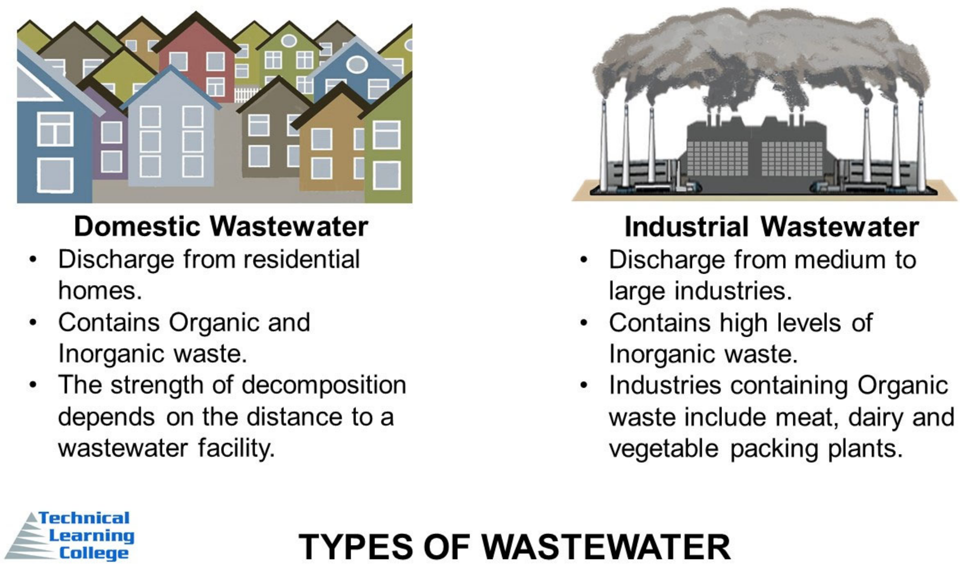
- Toxic organics, including solvents, pesticides, dioxins, and polychlorinated biphenyls (**PCBs**) can be cancer-causing and lead to other serious ailments, such as kidney and liver damage, anemia, and heart failure. In 1996, the EPA's Office of Science and Technology (**OST**) identified 2,193 water bodies with fish and wildlife advisories, up more than 25 percent from 1995.

Reductions in pollutants can ensure that industrial development vital to the economic well-being of a community is compatible with a healthy environment.

Many POTWs are responsible for ensuring that industrial and commercial facilities do not cause problems resulting from their discharges. In 1991, the EPA estimated that 190 to 204 million pounds of metals and 30 to 108 million pounds of organics were removed each year as a result of pretreatment program requirements.

This is substantiated by many POTWs that report significant reductions in the loadings of toxics to their treatment plants that is directly attributable to implementation of the National Pretreatment Program.

Priority Pollutant Introduction



Overview
Key features of the Priority Pollutant List and its relationship to the Toxic Pollutant List:

- The Priority Pollutants are a set of chemical pollutants EPA regulates, and for which EPA has published analytical test methods.
- The Priority Pollutant List makes the list of toxic pollutants more usable, in a practical way, for the purposes assigned to EPA by the Clean Water Act. For example, the Priority Pollutant list is more practical for testing and for regulation in that chemicals are described by their individual chemical names. The list of toxic pollutants, in contrast, contains open-ended groups of pollutants, such as "chlorinated benzenes." That group contains hundreds of compounds; there is no test for the group as a whole, nor is it practical to regulate or test for all of these compounds.

Derivation
Starting with the list of toxic pollutants, EPA used four criteria to select and prioritize specific pollutants:

- We included all pollutants specifically named on the list of toxic pollutants;
- There had to be a chemical standard available for the pollutant, so that testing for the pollutant could be performed;
- The pollutant had to have been reported as found in water with a frequency of occurrence of at least 2.5 percent, and
- The pollutant had to have been produced in significant quantities, as reported in Stanford Research Institute's "1976 Directory of Chemical Producers, USA."

Number of Entries
Originally, there were 129. When three pollutants were removed from the list of toxic pollutants in 1981 they were also removed from the Priority Pollutant List.

- Entry numbers 17, 49, and 50 were removed.
- The last number on the list is still 129, although there are 126 entries.

Appendix A to 40 CFR, Part 423--126 Priority Pollutants

001 Acenaphthene 002 Acrolein 003 Acrylonitrile 004 Benzene 005 Benzidine 006 Carbon tetrachloride (tetrachloromethane) 007 Chlorobenzene 008 1,2,4-trichlorobenzene 009 Hexachlorobenzene 010 1,2-dichloroethane 011 1,1,1-trichloreothane 012 Hexachloroethane 013 1,1-dichloroethane 014 1,1,2-trichloroethane 015 1,1,2,2-tetrachloroethane 016 Chloroethane 018 Bis(2-chloroethyl) ether 019 2-chloroethyl vinyl ether (mixed) 020 2-chloronaphthalene 021 2,4, 6-trichlorophenol 022 Parachlorometa cresol 023 Chloroform (trichloromethane) 024 2-chlorophenol 025 1,2-dichlorobenzene 026 1,3-dichlorobenzene 027 1,4-dichlorobenzene 028 3,3-dichlorobenzidine 029 1,1-dichloroethylene 030 1,2-trans-dichloroethylene 031 2,4-dichlorophenol 032 1,2-dichloropropane 033 1,2-dichloropropylene (1,3-dichloropropene) 034 2,4-dimethylphenol 035 2,4-dinitrotoluene 036 2,6-dinitrotoluene 037 1,2-diphenylhydrazine 038 Ethylbenzene 039 Fluoranthene 040 4-chlorophenyl phenyl ether 041 4-bromophenyl phenyl ether 042 Bis(2-chloroisopropyl) ether 043 Bis(2-chloroethoxy) methane 044 Methylene chloride (dichloromethane) 045 Methyl chloride (dichloromethane) 046 Methyl bromide (bromomethane)	047 Bromoform (tribromomethane) 048 Dichlorobromomethane 051 Chlorodibromomethane 052 Hexachlorobutadiene 053 Hexachloromyclopentadiene 054 Isophorone 055 Naphthalene 056 Nitrobenzene 057 2-nitrophenol 058 4-nitrophenol 059 2,4-dinitrophenol 060 4,6-dinitro-o-cresol 061 N-nitrosodimethylamine 062 N-nitrosodiphenylamine 063 N-nitrosodi-n-propylamin 064 Pentachlorophenol 065 Phenol 066 Bis(2-ethylhexyl) phthalate 067 Butyl benzyl phthalate 068 Di-N-Butyl Phthalate 069 Di-n-octyl phthalate 070 Diethyl Phthalate 071 Dimethyl phthalate 072 1,2-benzanthracene (benzo(a) anthracene 073 Benzo(a)pyrene (3,4-benzo-pyrene) 074 3,4-Benzofluoranthene (benzo(b) fluoranthene) 075 11,12-benzofluoranthene (benzo(b) fluoranthene) 076 Chrysene 077 Acenaphthylene 078 Anthracene 079 1,12-benzoperylene (benzo(ghi) perylene) 080 Fluorene 081 Phenanthrene 082 1,2,5,6-dibenzanthracene (dibenzo(,h) anthracene) 083 Indeno (,1,2,3-cd) pyrene (2,3-o-pheynylene pyrene) 084 Pyrene 085 Tetrachloroethylene 086 Toluene 087 Trichloroethylene 088 Vinyl chloride (chloroethylene) 089 Aldrin	090 Dieldrin 091 Chlordane (technical mixture and metabolites) 092 4,4-DDT 093 4,4-DDE (p,p-DDX) 094 4,4-DDD (p,p-TDE) 095 Alpha-endosulfan 096 Beta-endosulfan 097 Endosulfan sulfate 098 Endrin 099 Endrin aldehyde 100 Heptachlor 101 Heptachlor epoxide (BHC-hexachlorocyclohexane) 102 Alpha-BHC 103 Beta-BHC 104 Gamma-BHC (lindane) 105 Delta-BHC (PCB-polychlorinated biphenyls) 106 PCB-1242 (Arochlor 1242) 107 PCB-1254 (Arochlor 1254) 108 PCB-1221 (Arochlor 1221) 109 PCB-1232 (Arochlor 1232) 110 PCB-1248 (Arochlor 1248) 111 PCB-1260 (Arochlor 1260) 112 PCB-1016 (Arochlor 1016) 113 Toxaphene 114 Antimony 115 Arsenic 116 Asbestos 117 Beryllium 118 Cadmium 119 Chromium 120 Copper 121 Cyanide, Total 122 Lead 123 Mercury 124 Nickel 125 Selenium 126 Silver 127 Thallium 126 Silver 128 Zinc 129 2,3,7,8-tetrachloro-dibenzo-p-dioxin (TCDD)

Wastewater Priority Pollutants

The concentrations of various wastewater pollutants in dissolved, colloidal, and suspended form are typically low but can vary considerably. EPA Priority Pollutants refer to a list of 129 pollutants that includes heavy metals and specific organic chemicals. They were assigned a high priority for development of water quality criteria and effluent limitation guidelines because they are frequently found in wastewater. The EPA has published analytical test methods for all of them. Priority Pollutants are a subset of "*Toxic Pollutants*" as defined in the CWA. There are hundreds of *toxic pollutants*. There is no analytical test for the group as a whole, nor is it currently practical to regulate or test for all of these compounds in wastewater.

*Each POTW w*ith an approved pretreatment program must develop local limits for arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver and zinc. The POTW must also identify all *other pollutants of concern* and evaluate the need for limits for these pollutants.

The priority pollutant scans performed periodically by POTWs with approved pretreatment programs are useful in identifying *Pollutants of concern.* Many POTWs have surcharge programs for excess *Conventional pollutants.* A POTW should set absolute upper limits for *Conventional pollutants* in its sewer use ordinance (SUO) or industrial user (IU) permits, based on total plant capacity.

Excess Nutrients
Excess nutrients can stimulate the growth of algae and other aquatic plants. When these plants die and decompose, they may reduce the amount of *Oxygen* in the water.

Nutrients can also get into wastewater from industrial discharges, common household detergents and cleaners, runoff from streets and lawns and air pollutants that fall to the ground. Treatment plants cannot remove all *nutrients* from the wastewater.

"Heavy Metals" refers to dense, *metallic elements* that generally occur at trace levels in wastewater. Many heavy metals are toxic at low concentrations and most tend to accumulate.

Typical pesticides and herbicides include DDT, Aldrin, Chlordane, Endosulfan, Endrin, Heptachlor, and Diazinon. Surprisingly, concentrations of pesticides in urban runoff may be equal or greater than the pesticides in agricultural runoff. DDT is still present in stormwater.

PAHs spilled or released petroleum products (from oil spills or discharge of oil production brines) and combustion products that are found in urban runoff.

Polychlorinated biphenyls (PCBS) are *Organic chemicals* that formerly had widespread use in electrical transformers and hydraulic equipment. This class of chemicals is extremely persistent in the environment and has been proven to bioconcentrate in the food chain, thereby leading to environmental and human health concerns in areas such as the Great Lakes.

The Priority Pollutants are a set of *Chemical pollutants* EPA regulates, and for which EPA has published analytical test methods. *Priority Pollutant* list is more practical for testing and for regulation in that chemicals are described by their individual chemical names.

The list of toxic pollutants contains hundreds of compounds; there is no test for the group as a whole, nor is it practical to regulate or test for all of these compounds.

Specific Prohibitions

The specific prohibitions at 40 CFR Part 403.5(b) (PDF) are intended to “enhance control of hazardous wastes entering POTWs.” (55 FR 30082) These provisions forbid eight categories of pollutant discharges:

(1) Pollutants which create a fire or explosion hazard in the POTW, including, but not limited to, wastestreams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR Part 261.21 (PDF).

(2) Pollutants which will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, unless the works is specifically designed to accommodate such discharges.

(3) Solid or viscous pollutants in amounts which will cause obstruction to the flow in the POTW resulting in interference.

(4) Any pollutant, including oxygen demanding pollutants (biochemical oxygen demand, etc.) released in a discharge at a flow rate and/or pollutant concentration which will cause Interference with the POTW.

(5) Heat in amounts which will inhibit biological activity in the POTW resulting in Interference, but in no case heat in such quantities that the temperature at the POTW treatment plant exceeds 40 °C (104 °F) unless the approval authority, upon request of the POTW, approves alternate temperature limits.

(6) Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through.

(7) Pollutants which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity that may cause acute worker health and safety problems.

(8) Any trucked or hauled pollutants, except at discharge points designated by the POTW.”

Final Review Notes

CONVENTIONAL POLLUTANTS

POTWs are designed to treat typical household wastes and biodegradable commercial and biodegradable industrial wastes. The Clean Water Act defines the contaminants from these sources as **conventional pollutants**. **Conventional pollutants** are biological oxygen demand (BOD), total suspended solids (TSS), fecal coliform, oil and grease, and pH**.**

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GENERAL PROHIBITIONS

The federal pretreatment regulations at 40 CFR Part 403.5(a)(1) includes **"general prohibitions"** for industrial users stating that no user shall introduce into a POTW any pollutant(s) which causes pass through or interference. The federal regulations also established specific prohibitions for users.

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INDIRECT DISCHARGE

An **indirect discharge** is represented by an industry or business which sends wastewater to a sewer system tributary to a POTW in contrast to discharging directly into state surface waters. While **direct discharges** to surface waters are regulated under the NPDES permit program, indirect discharges are regulated as a component of the NPDES Permitting Program through the National Pretreatment Program. The National Pretreatment Program requires industrial and commercial dischargers to treat or control pollutants in their wastewater prior to discharge to POTWs.

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INTERFERENCE

Interference: a discharge from an industrial user that, alone or in conjunction with other sources a) inhibits or disrupts a POTW plant, its treatment processes or operations, or its sludge processes, use, or disposal, and b) therefore causes a violation including increasing a violation's magnitude or duration of any permit or rule that controls release of pollutants from the POTW.

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PASS-THROUGH

Pass-through: a POTW has a violation of its limits caused by an industrial users discharge that **passes through** the public facility without being adequately treated. The pollutant limit violated must be a pollutant discharged by the industrial user, but it's not necessary to demonstrate impact on the POTW operation.

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Summary

The National Pretreatment Program provides regulatory tools and authority to state and local POTW pretreatment programs for eliminating pollutant discharges that cause interference at POTWs, including interference caused by the discharge of Fats, Oils, and Grease (FOG) from food service establishments (FSE).

More specifically, the Pretreatment Program regulations at 40 CFR 403.5(b)(3) prohibit “solid or viscous pollutants in amounts which will cause obstruction” in the POTW and its collection system.

EPA’s Report to Congress on combined sewer overflows (CSOs) and sanitary sewer overflows (SSOs) identified that “grease from restaurants, homes, and industrial sources are the most common cause (47%) of reported blockages. Grease is problematic because it solidifies, reduces conveyance capacity, and blocks flow.”

Controlling FOG discharges will help POTWs prevent blockages that impact CSOs and SSOs, which cause public health and water quality problems.

Controlling FOG discharges from FSEs is an essential element in controlling CSOs and SSOs and ensuring the proper operations for many POTWs. The interference incidents identified in CSO/SSO report to Congress may indicate the need for additional oversight and enforcement of existing regulations and controls.

Topic 1 - Pretreatment Overview Section Post Quiz

This is not your final assignment, but is a short comprehension quiz. The answers are located in the rear near the references.

1. Sewer backups and overflows on streets, properties and even in customers' homes and/or businesses are caused because of improper disposal of fats, oils and grease, FOG builds up in the __________ and eventually block collection pipes and sewer lines, resulting in

2. Ponds, streams or rivers will be contaminated due to ___________ and will also impact the environment negatively.

Food Service Establishments (FSEs)

3. Because of the amount of grease used in cooking, __________________are a significant source of fats, oil and grease (FOG).

4. To assist improper handling and disposal of their FOG _______________ are generally developed to assist restaurants and other FSEs with instruction and compliance.

5. Through implementation of Best Management Practices (BMPs), these establishments should be able to significantly reduce the amount of FOG that goes down their drains. This will minimize back-ups and help business owners comply with the POTW's requirements.
A. True B. False

6. According to the text, the ____________________ can handle properly disposed wastes, but to work effectively, sewer systems need to be properly maintained, from the drain to the treatment plant.

7. Because our sewer system is fragile, ______________ is an example of a waste that the sewer system cannot handle, and therefore should not be put down the drain.

8. Various businesses and individuals to need to be responsible in maintaining the POTW system because repeated repairs are disruptive to residences and businesses alike. Proper sewer disposal by commercial establishments is required by____________________.

Environmental problem with FOG sewers

9. Grease balls are formed by_________________ that enters the sewer system eventually solidifies. The various sizes of these grease balls can range in size from marbles to the size of cantaloupes and must be removed periodically.

10. ______________________on the maintenance of the collection systems and/or treatment plants that in turn lead to higher customer rates are because the sewer system is unable to handle or treat these substances effectively.

11. The repair or replacement of their damaged property caused by FOG creating _____________ can also cost customers thousands of dollars for the repair or replacement of their damaged property.

Controlling FOG discharges

12. According to the text, FOG wastes are generated at _____________ as byproducts from food preparation activities.

13. There are generally two *FOG* captured on-site broad categories:

14. Food service establishment(s) collect and separate grease and from this procedure, ___________ is derived from used cooking oil and waste greases.

15. *Food service establishment(s) or FSE* can adopt a variety of best management practices or install interceptor/collector devices to control and capture the ___________________ before discharge to the POTW collection system.

16. The POTW collection system(s) will require that certain food service establishments install interceptor/collector devices (e.g., grease traps) in order to accumulate grease on-site and prevent it from entering the _________________________

Keeping Fats, Oils, and Grease out of the Sewer System

17. Manholes can overflow into parks, yards, streets, and storm drains, allowing FOG to contaminate local waters, including drinking water. Exposure to untreated wastewater is a public-health hazard and is an EPA violation. FOG discharged into septic systems and drain fields can cause malfunctions, resulting in more frequent tank pump-outs and other expenses.
A. True B. False

18. ________________ will back up into homes and businesses, resulting in high costs for cleanup and restoration. This is general because FOG is poured down kitchen drains accumulates inside sewer pipes. As the FOG builds up, it restricts the flow in the pipe and can cause this overflow and clogging.

POTWs control methods for FOG discharges from FSEs

19. There are many different devices, methods and procedures i.e., Proper design, installation, and maintenance procedures are critical for these devices to______________.

20. FOG must be able to cool and separate in a non-turbulent environment, therefore. ___________________ must be designed and sized appropriately.

Topic 2 - Pretreatment Program Development Section

Topic 2 - Section Focus: You will learn the basics of developing a pretreatment program: Including the administrative and engineering controls that prevents the introduction of pollutants into the POTW that will pass through the treatment works or are otherwise incompatible with treatment, prevent the introduction of pollutants that could interfere with POTW operations, including interference with the POTW's chosen sewage sludge use and disposal practices, as well as pollutants that could threaten worker health and safety. At the end of this section, you will be able to understand and describe pretreatment administrative (ordinance) and engineering techniques concerning the implementation of a pretreatment program. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 2 – Scope/Background: The POTW's pretreatment program identifies specific discharge standards and requirements that apply to sources of nondomestic wastewater discharged to a POTW. By reducing or eliminating waste at the industries ("source reduction"), fewer toxic pollutants are discharged to and treated by the POTWs, providing benefits to both the POTWs and the industrial users.

The National Pretreatment Program is unique in that the General Pretreatment Regulations require all large POTWs (i.e., those designed to treat flows of more than 5 million gallons per day) and smaller POTWs with significant industrial discharges to establish local pretreatment programs. These local programs must enforce all national pretreatment standards and requirements in addition to any more stringent local requirements necessary to protect site-specific conditions at the POTW.

Section 2.1 Design Flows of 5 Million Gallons

The General Pretreatment Regulations [40 CFR 403.8(a)] require all POTWs with design flows greater than 5 million gallons per day (mgd) and receiving industrial discharges that pass through or interfere with the operation of the POTW, or are otherwise subject to Pretreatment Standards, to develop local pretreatment programs (unless the state government has elected to administer the local program). EPA or a state authorized to implement a state pretreatment program may require other POTWs to implement pretreatment programs.

It is assumed for the purposes of this training manual that the POTW issuing Significant Industrial User (SIU) control mechanisms has an approved pretreatment program and is, thus, the Control Authority responsible for administering and enforcing the pretreatment program. The POTW's pretreatment program implementation and enforcement responsibilities are in the POTW's NPDES permit, and failure to adequately fulfill such activities constitutes an NPDES violation and could subject the POTW to enforcement actions.

States with approved pretreatment programs are responsible for overseeing and coordinating the development and approval of local pretreatment programs. Before state approval is obtained, EPA is the Approval Authority for local pretreatment programs. (NPDES states must receive EPA approval before they may function as Approval Authorities for pretreatment purposes. The conditions for approval are found at 40 CFR 403.10. Before this approval, EPA serves as the pretreatment Approval Authority, even where the state issues NPDES permits.) However, states may initiate pretreatment program activities even before their state program is approved.

EPA's General Pretreatment Regulations require POTWs to use a control mechanism that ensures that SIUs meet all applicable Pretreatment Standards and Requirements.

Furthermore, at the discretion of the POTW, this control may include the use of general control mechanisms (e.g., general permits) and individual control mechanisms (e.g., individual permits).

Before using general control mechanisms, the Control Authority must ensure that it has the legal authority to implement general control mechanisms. Associated procedures for issuing general control mechanisms must be incorporated into the approved program.

Even though the federal regulations state that POTWs can use permits, orders, or other similar means to control SIUs' discharges, it is EPA's experience that the permit is the most effective means of ensuring that industrial users are aware of all applicable pretreatment requirements. Permits allow for the systematic integration of all applicable requirements and, if properly structured, can greatly facilitate enforcement if noncompliance occurs. Therefore, EPA recommends that POTWs satisfy the control mechanism requirement [40 CFR 403.8(f)(1)(iii)] and the requirement that the POTW have procedures to notify SIUs of applicable Pretreatment Standards [40 CFR 403.8(f)(2)(iii)] by issuing permits to SIUs (for further details, see 55 FR 30082; July 24, 1990).

Regardless of the type of control mechanisms the POTW uses, each control mechanism issued to an SIU must contain all the minimum federal requirements. Throughout this document, the terms permit and control mechanism are used interchangeably.

2.2 Individual Permits or General Control Mechanisms

POTWs are required to issue control mechanisms to SIUs [as defined at 40 CFR 403.3(v)(1)]. Individual permits or general control mechanisms authorize the discharge of wastewater to a POTW upon condition that the discharger complies with the permit terms. An SIU permit is effective for only a limited period and should be revocable by the issuing authority at any time for just cause. In addition, the Control Authority's legal authority will typically include a provision that forbids the discharge of industrial wastewater from an SIU without a current Industrial User permit.

An individual permit or general control mechanism should describe, in a single document, all the duties and obligations of the permittee including all applicable Pretreatment Standards and Requirements.

At a minimum, it must include the following [40 CFR 403.8(f)(2)]:

- Prohibited discharge standards and applicable categorical standards, local limits
- Effluent limits (including Best Management Practices [BMPs]) that are based on applicable general Pretreatment Standards, categorical Pretreatment Standards, local limits, and state and local law
- Monitoring and reporting requirements
- Statement of permit duration
- Statement of non-transferability
- Statement of applicable civil and criminal penalties
- Requirements to control slug discharges if determined by the POTW to be necessary

Permits should not simply reference the applicable laws, but they must contain effluent limitations (expressed in terms of concentration or mass of pollutants that may be discharged over a given period including applicable BMPs), schedules for monitoring and reporting, requirements regarding sampling location and scope, and a description of potential civil and criminal penalties and liabilities, as set forth by the POTW's legal authority. Such conditions must reflect the most stringent of applicable federal, state, and local Pretreatment Standards and Requirements.

In many Industrial User permit programs, permittees are given an opportunity to review and comment on draft permits or challenge permit terms administratively within a specified period. If the permit is not challenged upon issuance, or if all opportunities for challenge of the final permit are exhausted, in most states, it becomes binding on the permittee.

Any violation of the permit is enforceable simply by proving that the permit included a certain term and that the term was violated. The POTW should determine the appropriate administrative appeals procedures as allowed under their state and local law.

POTW Pretreatment Program Requirements

The actual requirement for a POTW to develop and implement a local pretreatment program is a condition of its NPDES permit. Once the Approval Authority determines that a POTW needs a pretreatment program, the POTW's NPDES permit is modified to require development of a local program and submission of the program to the Approval Authority for review and approval. Consistent with §403.8(f), POTW pretreatment programs must contain the six minimum elements.

In addition to the six specific elements, pretreatment program submissions must include:

- a statement from the City Solicitor (or the like) declaring the POTW has adequate authority to carry out program requirements;
- copies of statutes, ordinances, regulations, agreements, or other authorities the POTW relies upon to administer the pretreatment program including a statement reflecting the endorsement or approval of the bodies responsible for supervising and/or funding the program;
- a brief description and organizational chart of the organization administering the program; and
- a description of funding levels and manpower available to implement the program.

Pretreatment program submissions found to be complete proceed to the public notice process, Public Participation and POTW Reporting. Upon program approval, the Approval Authority is responsible for modifying the POTW's NPDES permit to require implementation of the approved pretreatment program. Once approved, the Approval Authority oversees POTW pretreatment program implementation via receiving annual reports and conducting periodic audits and inspections.

As of early 1998, of the 1,578 POTWs required to develop pretreatment programs, 97 percent (1,535) have been approved. The National Pretreatment Program regulates IUs through three types of regulatory entities: the EPA, Approval Authorities, and Control Authorities. As noted above, Approval Authorities oversee Control Authorities while Control Authorities regulate IUs.

Using an extension pole with a sample attachment to grab a sample.

2.3 Who Issues Permits? *(Credit to EPA)*

POTWs with approved pretreatment programs are required to issue Industrial User permits or other authorized control mechanisms to their Industrial Users. Such POTWs are Control Authorities in the National Pretreatment Program. In states with approved state pretreatment programs, the state may assume responsibility for implementing POTWs' local pretreatment programs [40 CFR 403.10(e)]. In such cases, the state is the Control Authority and is required to issue Industrial User permits or other authorized control mechanisms to the Industrial Users.

In other cases, where the approved state pretreatment program selectively requires certain POTWs to develop approved POTW programs and assumes the responsibility for implementing other municipal programs, the state remains the Control Authority and issues the Industrial User permits to those facilities where it has retained that responsibility [40 CFR 403.10(e) and (f)]. Consequently, an Industrial User permit may be issued by those states rather than by POTWs. Of course, all states are free to issue such permits or other control mechanisms as they deem necessary to carry out the requirements of state law; this might be particularly appropriate where SIUs are discharging to a POTW that does not have an approved pretreatment program.

Why Permits are Recommended
The Control Authority must be able to regulate through permits, orders, or similar means the contributions of its Industrial Users to ensure that the requirements of the General Pretreatment Regulations are met [40 CFR 403.8(f)(l)(iii)]. As noted above, EPA believes that in most circumstances a permit program is the most effective mechanism for controlling wastewater discharges.

A permit system provides a mechanism for the Control Authority to control the discharges of Industrial Users to the POTW through an administrative process that facilitates understanding of Pretreatment Standards and Requirements. The permitting process allows the Control Authority to clearly communicate and address issues with an Industrial User before permit issuance.

Permittee's Responsibilities
A permit clearly identifies all the permittee's responsibilities and obligations in a single document, thereby increasing the understanding of the Industrial User with regard to pretreatment requirements. The permit issuance process itself leads to greater understanding and increased compliance rates by fostering dialogue and development of a one-on-one relationship between the POTW and an Industrial User.

Permit modification procedures can be established to provide flexibility to accommodate changes initiated by the Control Authority or by the Industrial User. For example, if an Industrial User significantly expands its process operation, the permit can be modified to reflect the increased wastewater discharge. In addition, the POTW may revise its local limits requiring a change to the Industrial User's permit. The ability to modify or revoke and reissue a permit also enables the Control Authority to accommodate changes in federal, state, and local requirements.

Permits are also easily enforced, provided that permit conditions are written clearly and concisely and require specific actions on the part of the Industrial User. For example, the Pretreatment Regulations require periodic monitoring by the Industrial User. Thus, the permit must state that an Industrial User must self-monitor rather than stating that the user should or may monitor.

Permits allow the POTW and interested citizens to measure the performance of the Industrial User against the permit conditions to determine compliance. In addition, where permittees are given only a limited period to challenge the substantive content of an Industrial User permit, enforcement actions brought after the limited time for review need only demonstrate noncompliance with the specific conditions of the permit; the calculation of applicable discharge limitations from narrative statutory and regulatory provisions is not at issue.

Permit Issuance Process

Before a Control Authority can begin issuing individual permits or general control mechanisms to Industrial Users, it must have adequate legal authority to do so, and it must make some basic policy decisions regarding how to identify possible Industrial Users, who will be required to obtain permits, when permits will be issued, the effective period or duration for permits, and the circumstances under which a permit may be modified or terminated. The following sections address factors that the Control Authority should consider when answering such questions and establishing its legal authority to implement and enforce its pretreatment program.

2.4 General Pretreatment Regulations at 40 CFR Part 403§ 403.1

Purpose and Applicability *(Credit USEPA)*

Figure 6. The General Pretreatment Regulations

§ 403.2 Objectives of general pretreatment regulations
§ 403.3 Definitions
§ 403.4 State or local law
§ 403.5 National pretreatment standards: Prohibited discharges
§ 403.6 National pretreatment standards: Categorical pretreatment standards
§ 403.7 Removal credits
§ 403.8 Pretreatment program requirements: Development and implementation by POTW
§ 403.9 POTW pretreatment programs and/or authorization to revise pretreatment standards: Submission for approval
§ 403.10 Development and submission of NPDES State pretreatment programs
§ 403.11 Approval procedures for POTW pretreatment programs and POTW granting of removal credits
§ 403.12 Reporting requirements for POTW's and industrial users
§ 403.13 Variances from categorical pretreatment standards for fundamentally different factors
§ 403.14 Confidentiality
§ 403.15 Net/Gross calculation
§ 403.16 Upset provision
§ 403.17 Bypass
§ 403.18 Modification of POTW pretreatment programs
Appendix A: Program Guidance Memorandum
Appendix B: [Reserved]
Appendix C: [Reserved]
Appendix D: Selected Industrial Subcategories Considered Dilute for Purposes of the Combined Wastestream Formula
Appendix E: Sampling Procedures
Appendix F: [Reserved]
Appendix G: Pollutants Eligible for a Removal Credit

The General Pretreatment Regulations

1. The General Pretreatment Regulations establish responsibilities of Federal, State, and local government, industry and the public to implement Pretreatment Standards to control pollutants which pass through or interfere with POTW treatment processes or which may contaminate sewage sludge. The regulations, which have been revised numerous times since originally published in 1978, consist of 18 sections and several appendices.

2. The General Pretreatment Regulations apply to all non-domestic sources which introduce pollutants into a POTW. These sources of "***indirect discharge***" are more commonly referred to as industrial users (**IUs**).

3. Since IUs can be as simple as an unmanned coin operated car wash to as complex as an automobile manufacturing plant or a synthetic organic chemical producer, EPA developed four criteria that define a Significant Industrial User (**SIU**). Many of the General Pretreatment Regulations apply to SIUs as opposed to IUs, based on the fact that control of SIUs should provide adequate protection of the POTW.

These four criteria are as follows:

- An IU that discharges an average of 25,000 gallons per day or more of process wastewater to the POTW;
- An IU that contributes a process wastestream making up 5 percent or more of the average dry weather hydraulic or organic capacity of the POTW treatment plant;
- An IU designated by the Control Authority as such because of its reasonable potential to adversely affect the POTW's operation or violate any pretreatment standard or requirement; or
- An IU subject to Federal categorical pretreatment standards.

Unlike other environmental programs that rely on Federal or State governments to implement and enforce specific requirements, the Pretreatment Program places the majority of the responsibility on local municipalities. Specifically, section 403.8(a) of the General Pretreatment Regulations states that any POTW (or combination of treatment plants operated by the same authority) with a total design flow greater than 5 million gallons per day (MGD) and smaller POTWs with SIUs must establish a local pretreatment program.

As of early 1998, 1,578 POTWs are required to have local programs. While this represents only about 15 percent of the total treatment plants nationwide, these POTWs account for more than 80 percent (i.e., approximately 30 billion gallons a day) of the national wastewater flow.

Control Authority

The General Pretreatment Regulations define the term “Control Authority” as a POTW that administers an approved pretreatment program since it is the entity authorized to control discharges to its system.

Section 403.10(e) provides States authority to implement POTW pretreatment programs in lieu of POTWs. Five States have elected to assume this responsibility (Vermont, Connecticut, Alabama, Mississippi, and Nebraska). In these instances, the State is defined as the Control Authority. As described above, all Control Authorities must establish a local pretreatment program to control discharges from non-domestic sources.

Approval Authority

These programs must be approved by the “Approval Authority” who is also responsible for overseeing implementation and enforcement of these programs.

As of 6/2020, a total of 47 States /Territories are authorized to implement State NPDES Permit Programs, but only 37 are authorized to be the Pretreatment Program Approval Authority. In all other States and Territories (including the 403.10(e) States), the EPA is considered to be the Approval Authority. In all other States and Territories (including the 403.10(e) States), the EPA is considered to be the Approval Authority.

2.5 Six Minimum Pretreatment Program Elements

1. Legal Authority (*see ordinance example in the rear*)
The POTW must operate pursuant to legal authority enforceable in Federal, State or local courts, which authorizes or enables the POTW to apply and enforce any pretreatment regulations developed pursuant to the CWA. At a minimum, the legal authority must enable the POTW to:
I. deny or condition discharges to the POTW;
 ii. require compliance with pretreatment standards and requirements;
 iii. control IU discharges through permits, orders, or similar means;
 iv. require IU compliance schedules when necessary to meet applicable pretreatment standards and/or requirements and the submission of reports to demonstrate compliance;
 v. inspect and monitor IUs;
 vi. obtain remedies for IU noncompliance; and
 vii. comply with confidentiality requirements.

2. Procedures
The POTW must develop and implement procedures to ensure compliance with pretreatment requirements, including:
 I. identify and locate all IUs subject to the pretreatment program;
 ii. identify the character and volume of pollutants contributed by such users;
 iii. notify users of applicable pretreatment standards and requirements;
 iv. receive and analyze reports from IUs;
 v. sample and analyze IU discharges and evaluate the need for IU slug control plans;
 vi. investigate instances of noncompliance; and
 vii. comply with public participation requirements.

3. Funding
The POTW must have sufficient resources and qualified personnel to carry out the authorities and procedures specified in its approved pretreatment program.

4. Local limits
The POTW must develop local limits or demonstrate why these limits are not necessary.

5. Enforcement Response Plan (ERP)
The POTW must develop and implement an ERP that contains detailed procedures indicating how the POTW will investigate and respond to instances of IU noncompliance.

6. List of SIUs
The POTW must prepare, update, and submit to the Approval Authority a list of all Significant Industrial Users (**SIUs**).

2.6 Pretreatment Roles and Responsibilities

EPA Headquarters

< Oversees program implementation at all levels
< Develops and modifies regulations for the program
< Develops policies to clarify and further define the program
< Develops technical guidance for program implementation
< Initiates enforcement actions as appropriate

Regions

< Fulfill Approval Authority responsibilities for States without a State pretreatment program
< Oversee State program implementation
< Initiate enforcement actions as appropriate.

Approval Authorities (EPA Regions and delegated States)

< Notify POTWs of their responsibilities
< Review and approve requests for POTW pretreatment program approval or modification
< Review requests for site-specific modifications to categorical pretreatment standards
< Oversee POTW program implementation
< Provide technical guidance to POTWs
< Initiate enforcement actions, against noncompliant POTWs or industries.

Control Authorities (POTWs, States, or EPA Regions)

< Develop, implement, and maintain approved pretreatment program
< Evaluate compliance of regulated IUs
< Initiate enforcement action against industries as appropriate
< Submit reports to Approval Authorities
< Develop local limits (or demonstrate why they are not needed)
< Develop and implement enforcement response plan.

Industrial Users

< Comply with applicable pretreatment standards and reporting requirements.
(Credit USEPA)

2.7 Types of Businesses Subject to Pretreatment Regulations

Pretreatment regulations apply to a variety of businesses discharging wastewater from industrial and commercial processes.

Certain types of industries with the potential to discharge pollutants are regulated through an industrial discharge permit system. Industries are considered

Significant Industrial Users and therefore require a discharge permit if the user:

- Is subject to the Environmental Protection Agency's Categorical Pretreatment Standards. Categorical users receive increased scrutiny due to their potential to pollute. Examples of categorical users are metal finishers and pharmaceutical manufacturers.
- Is discharging an average of 25,000 gallons per day or more of process wastewater.
- Has the potential to adversely affect the wastewater utility.

Industry-Specific Guides

Aluminum, Copper, And Nonferrous Metals Forming and Metal Powders

- Pretreatment Standards: A Guidance Manual
- Guidance Manual For Battery Manufacturing Pretreatment Standards
- Guidance Manual for Electroplating and Metal Finishing Pretreatment Standard
- Guidance Manual For Iron And Steel Manufacturing Pretreatment Standards
- Guidance Manual for Leather Tanning and Finishing Pretreatment Standards
- Guidance Manual for Pulp, Paper, Paperboard, Builders' Paper, and
- Board Mills Pretreatment Standards

Pretreatment Standards

The National Pretreatment Program identifies specific requirements that apply to all IUs, additional requirements that apply to all SIUs, and certain requirements that only apply to CIUs. The objectives of the National Pretreatment Program are achieved by applying and enforcing three types of discharge standards:

< ***prohibited discharge standards***
< ***categorical standards***
< ***local limits***.

2.8 Categorical Pretreatment Standards *(Credit USEPA)*

Categorical pretreatment standards (i.e., categorical standards) are national, uniform, technology-based standards that apply to discharges to POTWs from specific industrial categories (i.e., indirect dischargers) and limit the discharge of specific pollutants. Categorical pretreatment standards for both existing and new sources (PSES and PSNS, respectively) are promulgated by the EPA pursuant to Section 307(b) and (c) of the CWA. Limitations developed for indirect discharges are designed to prevent the discharge of pollutants that could pass through, interfere with, or otherwise be incompatible with POTW operations. Effluent limitations guidelines (ELGs), developed in conjunction with categorical standards, limit the discharge from facilities directly to waters of the U.S. (i.e., direct dischargers) and do not apply to indirect dischargers.

ELGs include Best Practicable Control Technology Currently Available (BPT), Best Conventional Pollutant Control Technology (BCT), and Best Available Technology Economically Achievable (BAT) limitations and New Source Performance Standards (NSPS). ELGs (i.e., BPT, BCT, BAT, and NSPS) do not apply to indirect dischargers. The significant difference between categorical standards and effluent limitations guidelines is that categorical standards account for any pollutant removal that may be afforded through treatment at the POTW, while effluent limitations guidelines do not. Industries identified as major sources of toxic pollutants are typically targeted for effluent guideline and categorical standard development.

If limits are deemed necessary, the EPA investigates affected IUs and gathers information regarding process operations as well as treatment and management practices accounting for differences in facility size and age, equipment age, and wastewater characteristics.

Sub categorization within an industrial category is evaluated based on variability in processes employed, raw materials used, types of items produced, and characteristics of wastes generated. Availability and cost of control technologies, non-water quality environmental impacts, available pollution prevention measures, and economic impacts are then identified prior to the EPA's presentation of findings in proposed development documents and publishing a notice of the proposed regulations in the *Federal Registe*r. Based on public comments on the proposed rule, the EPA promulgates (i.e., publishes) the standards.

Interference and Pass Through

Pass through - A discharge which exits the POTW into waters of the US in quantities or concentrations which, alone or in conjunction with a discharge or discharges from other sources, is a cause of a violation of any requirement of the POTW's NPDES permit (including an increase in the magnitude or duration of a violation).

Interference - A discharge which, alone or in conjunction with a discharge or discharges from other sources, both (1) inhibits or disrupts the POTW, its treatment processes or operations, or its sludge processes, use or disposal; and (2) therefore is a cause of a violation of any requirement of the POTW's NPDES permit or of the prevention of sewage sludge use or disposal.

2.9 Prohibited Discharge Standards *(Credit USEPA)*

All IUs, whether or not subject to any other National, State, or local pretreatment requirements, are subject to the general and specific prohibitions identified in 40 CFR §§403.5(a) and (b), respectively. General prohibitions forbid the discharge of any pollutant(s) to a POTW that cause pass through or interference.

Specific prohibitions forbid eight categories of pollutant discharges as follows:

(1) discharges containing pollutants which create a fire or explosion hazard in the POTW, including but not limited to, wastestreams with a closed cup flashpoint of less than 140°F (60°C) using the test methods specified in 40 CFR §261.21;

(2) discharges containing pollutants causing corrosive structural damage to the POTW, but in no case discharges with a pH lower than 5.0, unless the POTW is specifically designed to accommodate such discharges;

(3) discharges containing pollutants in amounts causing obstruction to the flow in the POTW resulting in interference;

(4) discharges of any pollutants released at a flow rate and/or concentration which will cause interference with the POTW;

(5) discharges of heat in amounts which will inhibit biological activity in the POTW resulting in interference, but in no case heat in such quantities that the temperature at the POTW treatment plant exceeds 40°C (104°F) unless the Approval Authority, upon request of the POTW, approves alternative temperature limits;

(6) discharges of petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin in amounts that will cause interference or pass through;

(7) discharges which result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity that may cause acute worker health and safety problems; and

(8) discharges of trucked or hauled pollutants, except at discharge points designated by the POTW.

Compliance with the general and specific prohibitions is mandatory for all IUs, although a facility may have an affirmative defense in any action brought against it alleging a violation of the general prohibitions or of certain specific prohibitions [(3), (4), (5), (6) and (7) above] where the IU can demonstrate it did not have reason to know that its discharge, alone or in conjunction with a discharge or discharges from other sources, would cause pass through or interference, and the IU was in compliance with a technically-based local limit developed to prevent pass through or interference.

These prohibited discharge standards are intended to provide general protection for POTWs. However, their lack of specific pollutant limitations creates the need for additional controls, namely categorical pretreatment standards and local limits.

The refrigerated automatic WWT sampler will have a data programmer that will allow you to set the time to collect the sample or samples. This machine can also measure the amount of the sample. These can devices also be used for the collection of composite samples. Sometimes you will see a pH probe with real-time readings sent to the Operator's Command Center. These devices are a common sight at most wastewater plants and SIUs.

Attachment 3-1: Summary of Categorical Standards

EPA has established categorical pretreatment standards (for indirect dischargers) for 35 categories. Plans for EPA's expansion and modification of the list are detailed in the *Effluent Guidelines Plan*, published in the *Federal Register* biennially as required at CWA section 304(m). The list of the industrial categories that have categorical pretreatment standards—Pretreatment Standards for Existing Sources (PSES) and Pretreatment Standards for New Sources (PSNS)—as of March 2011 is provided below.

Summary of categorical pretreatment standards

No.	Category	40 CFR Part	Subparts	Type of standard	Overview of pretreatment standards
1	Aluminum Forming	467	A–F	PSES PSNS	Limits are production-based daily maximums and monthly averages. Subpart C prohibits discharges from certain operations.
2	Battery Manufacturing	461	A–G	PSES PSNS	Limits are production-based daily maximums and monthly averages. No discharge is allowed from any process not specifically identified in the regulations.
3	Carbon Black Manufacturing	458	A–D	PSNS	Limits are for oil and grease only (no duration specified).
4	Centralized Waste Treatment	437	A–D	PSES PSNS	Limits are concentration-based daily maximums and monthly averages.
5	Coil Coating	465	A–D	PSES PSNS	Limits are production-based daily maximums and monthly averages.
6	Concentrated Animal Feeding Operations (CAFO)	412	B	PSNS	Discharge of process wastewater is prohibited, except when there is an overflow resulting from a chronic or catastrophic rainfall event.
7	Copper Forming	468	A	PSES PSNS	Limits are production-based daily maximums and monthly averages.
8	Electrical and Electronic Components	469	A–D	PSES PSNS	Limits are concentration-based daily maximums and 30-day averages or monthly averages (varies per subpart and pollutant parameter). Certification is allowed in lieu of monitoring for certain pollutants when a management plan is approved and implemented.
9	Electroplating	413	A,B,D–H	PSES	Limits are concentration-based (or alternative mass-based equivalents) daily maximums and four-consecutive-monitoring-days averages. Two sets of limits exist, depending on whether facility is discharging more or less than 10,000 gpd of process wastewater. Certification is allowed in lieu of monitoring for certain pollutants when a management plan is approved and implemented.

No.	Category	40 CFR Part	Subparts	Type of standard	Overview of pretreatment standards
10	Fertilizer Manufacturing	418	A–G	PSNS	Limits may specify zero discharge of wastewater pollutants (Subpart A), production-based daily maximums, and 30-day averages (Subparts B–E), or may be concentration-based (Subparts F–G), with no duration of limit specified.
11	Glass Manufacturing	426	H K–M	PSNS	Limits are concentration- or production-based daily maximums and monthly averages.
12	Grain Mills	406	A	PSNS	Discharge of process wastewater is prohibited at a flow rate or mass loading rate (BOD_5 and TSS) that is excessive during periods when a POTW is receiving peak loads.
13	Ink Formulating	447	A	PSNS	Regulations specify no discharge of process wastewater pollutants to a POTW.
14	Inorganic Chemicals Manufacturing	415	A,B,F,L, AH,AJ,AL, AR,AU,BC, BL,BM,BO	PSES	Limits vary for each subpart with a majority of the limits concentration-based, daily maximums, and 30-day averages, or they may specify no discharge of wastewater pollutants.
			B–F, H, K–N,P,Q, T,V,AA, AC,AE,AH AI,AJ,AL, AN,AP,AQ AR,AU,AX BB,BC, BH, BK–BO	PSNS	
15	Iron and Steel Manufacturing	420	A–F, H–J, L	PSES PSNS	Limits are production-based daily maximums and 30-day averages.
16	Leather Tanning and Finishing	425	A–I	PSES PSNS	Limits are concentration-based daily maximums and monthly averages. In certain instances, applicability of pretreatment standards is dictated by volume of production.
17	Metal Finishing	433	A	PSES PSNS	Limits are concentration-based daily maximums and monthly averages. Certification is allowed for certain pollutants where a management plan is approved and implemented.
18	Metal Molding and Casting	464	A–D	PSES PSNS	Limits are primarily production-based daily maximums and monthly averages. Discharges from certain processes are prohibited (Subparts A–C).
19	Nonferrous Metals Forming and Metal Powders	471	A–J	PSES PSNS	Limits are production-based daily maximums and monthly averages. In some instances, the discharge of wastewater pollutants is prohibited.

No.	Category	40 CFR Part	Subparts	Type of standard	Overview of pretreatment standards
20	Nonferrous Metals Manufacturing	421	C,F–M,P, Q,V,X,Y, AA–AC	PSES	Limits are production-based daily maximums and monthly averages. PSES (Subpart F) specify no discharge from existing facilities of process wastewater pollutants to the POTW except for some stormwater events.
			A–Z, AA–AE	PSNS	Limits are production-based daily maximums and monthly averages. PSNS (Subparts D and F) specify no discharge from existing facilities of process wastewater pollutants to the POTW.
21	Oil and Gas Extraction	435	D	PSES PSNS	Regulations specify no discharge of wastes (e.g., produced water, drill cuttings) to a POTW.
22	Organic Chemicals, Plastics, and Synthetic Fibers	414	B–H, K	PSES PSNS	Limits are mass-based (concentration-based standards multiplied by process flow) daily maximums and monthly averages. Standards for metals and cyanide apply only to metal- or cyanide-bearing wastestreams.
23	Paint Formulating	446	A	PSNS	Regulations specify no discharge of process wastewater pollutants to the POTW.
24	Paving and Roofing Materials (Tars and Asphalt)	443	A–D	PSNS	Limits are for oil and grease only (no limit duration specified).
25	Pesticide Chemicals	455	A, C, E	PSES PSNS	Limits are mass-based (concentration-based standards multiplied by process flow) daily maximums and monthly averages. Subpart C specifies no discharge of process wastewater pollutants but provides for pollution-prevention alternatives. Subpart E specifies no discharge of process wastewater pollutants.
26	Petroleum Refining	419	A–E	PSES PSNS	Limits are concentration-based (or mass-based equivalent) daily maximums.
27	Pharmaceutical Manufacturing	439	A–D	PSES PSNS	Limits are concentration-based daily maximums and monthly averages. Such facilities may certify that they do not use or generate cyanide in lieu of performing monitoring to demonstrate compliance.
28	Porcelain Enameling	466	A–D	PSES PSNS	Limits are concentration-based (or alternative production-based) daily maximums and monthly averages. Subpart B prohibits discharges from certain operations.

No.	Category	40 CFR Part	Subparts	Type of standard	Overview of pretreatment standards
29	Pulp, Paper, and Paperboard	430	A–G, I–L	PSES PSNS	Limits are production-based daily maximums and monthly averages. Such facilities may certify that they do not use certain compounds in lieu of performing monitoring to demonstrate compliance. Facilities subject to Subparts B and E must also implement BMPs as identified.
30	Rubber Manufacturing	428	E–K	PSNS	Limits are concentration- or production-based daily maximums and monthly averages.
31	Soap and Detergent Manufacturing	417	O–R	PSNS	Regulations specify no discharge of process wastewater pollutants to a POTW when the wastewater chemical oxygen demand (COD)/BOD_7 ratio exceeds 10.0 and the COD concentrations exceed subcategory specific concentrations.
32	Steam Electric Power Generating	423	—	PSES PSNS	Limits are concentration-based daily maximums, or *maximums for any time*, or compliance may be demonstrated through engineering calculations.
33	Timber Products Processing	429	F–H	PSES PSNS	All PSNS (and PSES for Subpart F) prohibit the discharge of wastewater pollutants. PSES for Subparts G and H are concentration-based daily maximums (with production-based alternatives).
34	Transportation Equipment Cleaning	442	A–C	PSES PSNS	Operators subject to effluent guidelines in subparts A–B must either meet concentration-based daily maximum standards or develop a Pollutant Management Plan. Operators subject to effluent guidelines in subpart C must meet concentration-based daily maximum standards.
35	Waste Combustors	444	A	PSES PSNS	Limits are concentration-based daily maximums and monthly averages.

Definition of New Source (40 CFR 403.3(k)) *(Credit USEPA)*

New Source is defined at 40 CFR §403.3 (k)(1) to mean any building, structure, facility or installation from which there is or may be a discharge of pollutants, the construction of which commenced after publication of proposed Pretreatment Standards under Section 307(c) of the Act which will be applicable to such source if Standards are thereafter promulgated in accordance with that section, *provided that:*

(i) the building, structure, facility, or installation is constructed at a site at which no other source is located; or

(ii) the building, structure, facility, or installation totally replaces the process or production equipment that causes the discharge of pollutants at an existing source; or

(iii) the production or wastewater generating processes of the building, structure, facility or installation are substantially independent of an existing source at the same site. In determining whether these are substantially independent, factors such as the extent to which the new facility is integrated with the existing plant, and the extent to which the new facility is engaged in the same general type of activity as the existing source should be considered.

(2) Construction on a site at which an existing source is located results in a modification rather than a new source if the construction does not create a new building, structure, facility, or installation meeting the criteria of paragraphs (k)(1)(ii), or (k)(1)(iii) of this section but otherwise alters, replaces, or adds to existing process or production equipment.

(3) Construction of a new source as defined under this paragraph has commenced if the owner or operator has:

(i) begun, or caused to begin as part of a continuous onsite construction program:

(ii) any placement, assembly or installation of facilities or equipment, or

(B) significant site preparation work, including clearing, excavation, or removal of existing buildings, structures, or facilities which is necessary for the placement, assembly, or installation of new source facilities or equipment; or

(ii) entered into a binding contractual obligation for the purchase of facilities or equipment which are intended to be used in its operation within a reasonable time.

Options to purchase or contracts which can be terminated or modified without substantial loss, and contracts for feasibility, engineering, and design studies do not constitute a contractual obligation under this paragraph.

New Source

As noted above, categorical pretreatment standards are developed both for existing (PSES) and new sources (PSNS). Facilities are classified as either PSES or PSNS based on the definition of “new source" set out in 40 CFR§403.3(k) of the General Pretreatment Regulations. Dischargers subject to PSES are required to comply with those standards by a specified date, typically no more than three years after the effective date of the categorical standard. Users subject to PSNS, however, are required to achieve compliance within the shortest feasible time, not to exceed 90 days from commencement of discharge. PSNS are often more stringent than PSES based on the opportunity for new sources to install the best available demonstrated technology and operate the most efficient production processes.

Congress established an initial list of 21 categorical industries under Section 306 of the CWA of 1972. As a result of various court decrees and settlement agreements resulting from litigation, and from the EPA's internal work plan development process, the EPA has developed effluent guidelines (for direct dischargers) and/or categorical pretreatment standards (for indirect dischargers) for 51 industrial categories.

Of these industrial categories, the EPA implements pretreatment standards for 35 categories, and either requires compliance solely with 40 CFR Part 403 General Pretreatment Regulations or does not address pretreatment standards for the remaining categories.

Plans for the EPA's expansion and modification of the list is detailed in the *Effluent Guidelines Plan,* published in the *Federal Register* biennially as required in section 304(m) of the CWA. A list of the industrial categories that have categorical standards is provided as Figure 2.10. Categorical pretreatment standards developed can be concentration-based or mass-based.

Concentration-based standards are expressed as milligrams of pollutant allowed per liter (mg/l) of wastewater discharged and are issued where production rates for the particular industrial category do not necessarily correlate with pollutant discharges.

Mass-based standards are generally expressed on a mass per unit of production (e.g., milligrams of pollutant per kilogram of product produced, pounds of pollutant per million cubic feet of air scrubbed, etc.) and are issued where water conservation is an important component in the limitation development process.

For a few categories where reducing a facility's flow volume does not provide a significant difference in the pollutant load discharged, the EPA has established both mass and concentration-based standards. Generally, both a daily maximum limitation and a long-term average limitation (e.g., average daily values in a calendar month) are established for every regulated pollutant.

2.11 CWF vs. FWA

Categorical standards apply to regulated wastewaters, i.e. wastewater from an industrial process that is regulated for a particular pollutant by a categorical pretreatment standard. Therefore, demonstrating compliance with categorical pretreatment standards is intended to be based on measurements of wastestreams containing only the regulated process wastewater.

However, recognizing isolation of regulated wastestreams from nonregulated wastestreams was not always practicable or desirable, the EPA developed the combined wastestream formula (CWF) and flow weighted average (FWA) approach for determining compliance with combined wastestreams.

Pursuant to 40 CFR §403.6(e), the CWF is applicable where a regulated wastestream combines with one or more unregulated or dilute wastestreams prior to treatment. Where nonregulated wastestreams combine with process streams after pretreatment, the more stringent approach (whether CWF or FWA) is used to adjust the limits.

The CWF and FWA approaches differ primarily in their allowances for nonregulated wastestreams. While the CWF provides a *"full credit"* (i.e., same pollutant levels as regulated wastestreams) for unregulated wastestreams yet no credit for dilute wastestreams, the FWA requires sampling and analysis of the untreated, nonregulated wastestreams to determine the credit to be granted (not to exceed that allowed for the regulated wastestreams).

Application of the CWF and FWA requires proper identification, classification, and quantification of the three wastestream types. Note: in circumstances where boiler blowdown, noncontact cooling water, stormwater, or demineralized wastestreams contain a significant amount of a regulated pollutant, and the treatment of the wastewater with the regulated wastestream results in substantial reduction of the regulated pollutant, the Control Authority can classify the wastestream as unregulated rather than as a dilute wastestream.

Measuring device known as a *"Parshall Flume".*
Several POTW's are requiring the SIU to cover the flume inside the vault to lower the hazard of a permit required confined space.

EXAMPLE OF FACT SHEET
DOCMENTING THE DETERMINATION OF THE MOST STRINGENT DAILY MAXIMUM EFFLUENT LIMITS

Parameter	Daily PSES	Monthly PSES	Daily CWF	Monthly CWF	Local Daily Limits	Daily Final Limit	Monthly final limit**
Cadmium	0.69	0.26	0.46	0.17	0.10	0.10	0.17
Chromium (Hex)	________	________	________	________	0.10	0.10	________
Chromium (Total)	2.77	1.71	1.85	1.14	1.0	1.0	1.14
Copper	3.38	2.07	2.26	1.38	5.0	2.26	1.38
Cyanide	6.0	0.65	*	*	2.0	2.0	0.65*
Lead	0.69	0.04	0.46	0.29	0.10	0.10	0.29
Manganese	--------	---------	---------	---------	1.00	1.00	---------
Mercury	---------	---------	---------	---------	0.005	0.005	---------
Nickel	3.98	2.38	2.66	1.59	2.0	2.0	1.59
Silver	0.04	0.24	0.28	0.16	0.1	0.1	0.16
Zinc	2.61	1.48	1.74	0.99	5.0	1.74	0.99
TTO* **	2.13	---------	1.42	---------	1.0	1.0	---------

Note: All concentrations are in mg/L unless otherwise noted.

Key:
PSES = Pretreatment Standards for Existing Sources, metal finishing category (40 CFR Part 433.15 (a))

CWF = Alternative metal - finishing standards after use of the combined wastestream formula.

Local Limits = Maximum pollutant concentrations established by the Control Authority

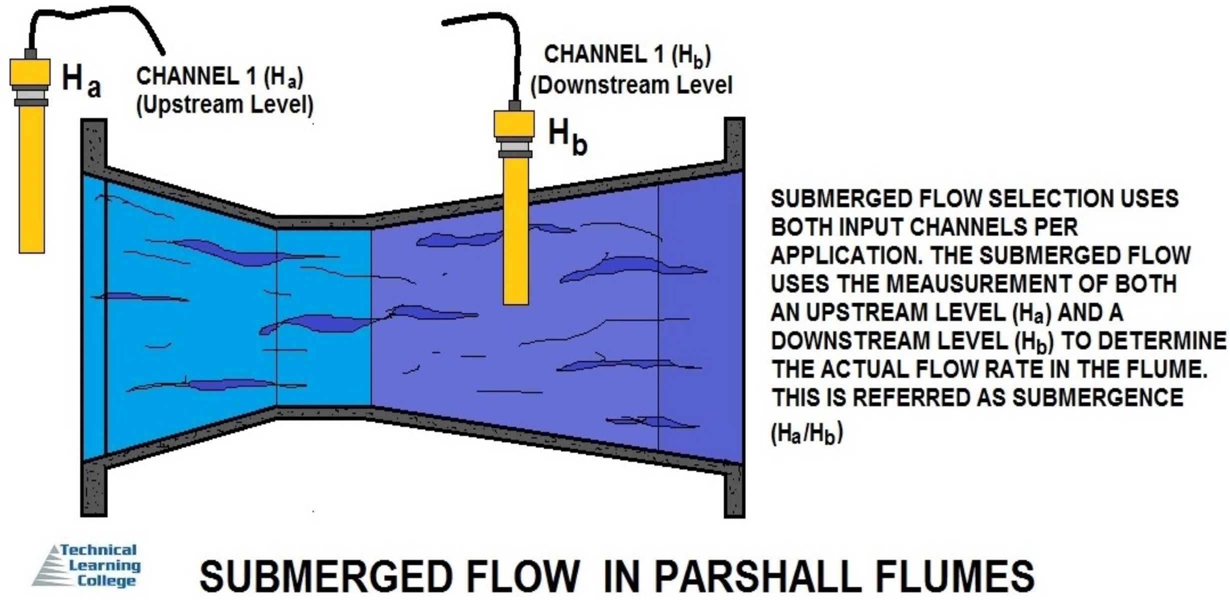
Final Limit = Final limits based on most stringent of local, state, and federal standards

*Cyanide limits must apply to the segregated cyanide wastestream of the cyanide destruct treatment process

**The discharger required to comply with both the daily maximum and monthly average limits, if applicable.

***The pollutants regulated by the categorical TTO limit and the local TTO limit are the same.

2.12 Parshall Flumes and Measuring Flow



The **Parshall flume** is an open channel flow-metering device that was developed to measure the flow of surface waters and irrigation flows. The Parshall flume is a fixed hydraulic structure. It is used to measure volumetric flow rate in industrial discharges, municipal sewer lines, and influent/effluent flows in wastewater treatment plants. The Parshall flume accelerates flow through a contraction of both the parallel sidewalls and a drop in the floor at the flume throat. Under free-flow conditions, the depth of water at specified location upstream of the flume throat can be converted to a rate of flow. Some states specify the use of Parshall flumes, by law, for certain situations (commonly water rights).

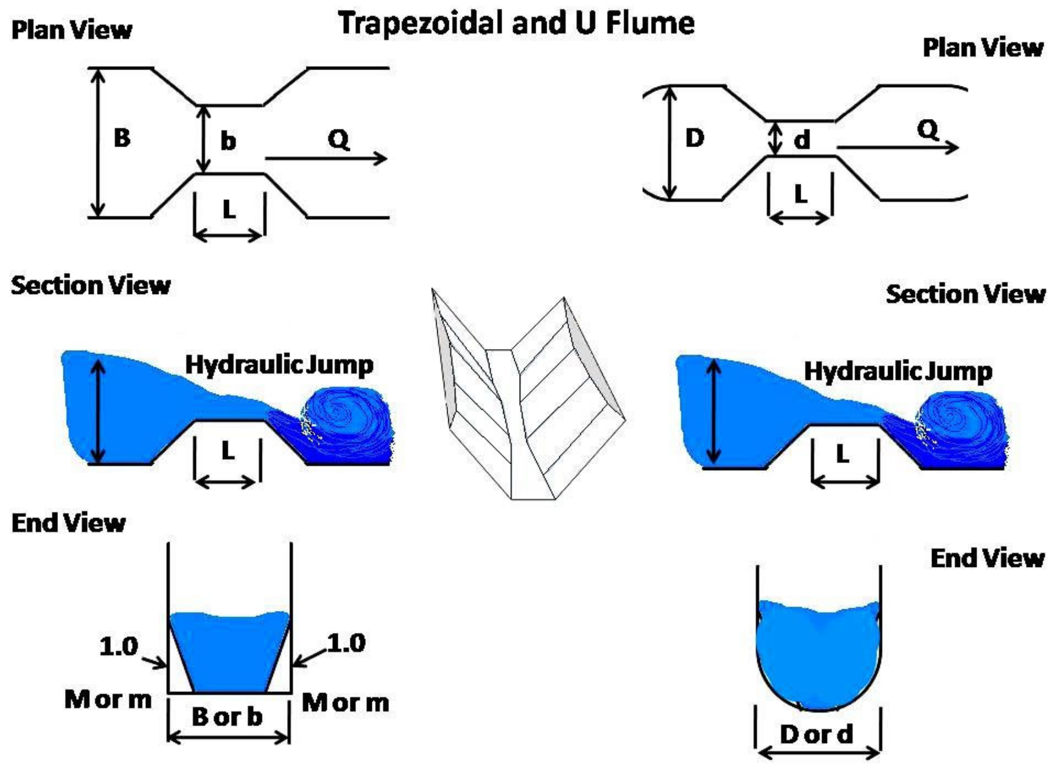
The design of the Parshall flume is standardized under ASTM D1941, ISO 9826:1992, and JIS B7553-1993. The flumes are not patented and the discharge tables are not copyright protected.
A hydraulic jump occurs downstream of the flume for free flow conditions. As the flume becomes submerged, the hydraulic jump diminishes and ultimately disappears as the downstream conditions increasingly restrict the flow out of the flume.
Animation of a Parshall flume

The free-flow discharge can be summarized as

Q = $$Q = CH_a^n$$

where

- *Q* is flow rate
- *C* is the free-flow coefficient for the flume
- H_a is the head at the primary point of measurement
- *n* varies with flume size (e.g. 1.55 for a 1-inch flume)



More on Parshall Flumes

Parshall Flume provides both accuracy and rangeability. Dimensions and capacities are in accordance with those published in the U.S. Department of the Interior's Water Measurement Manual.

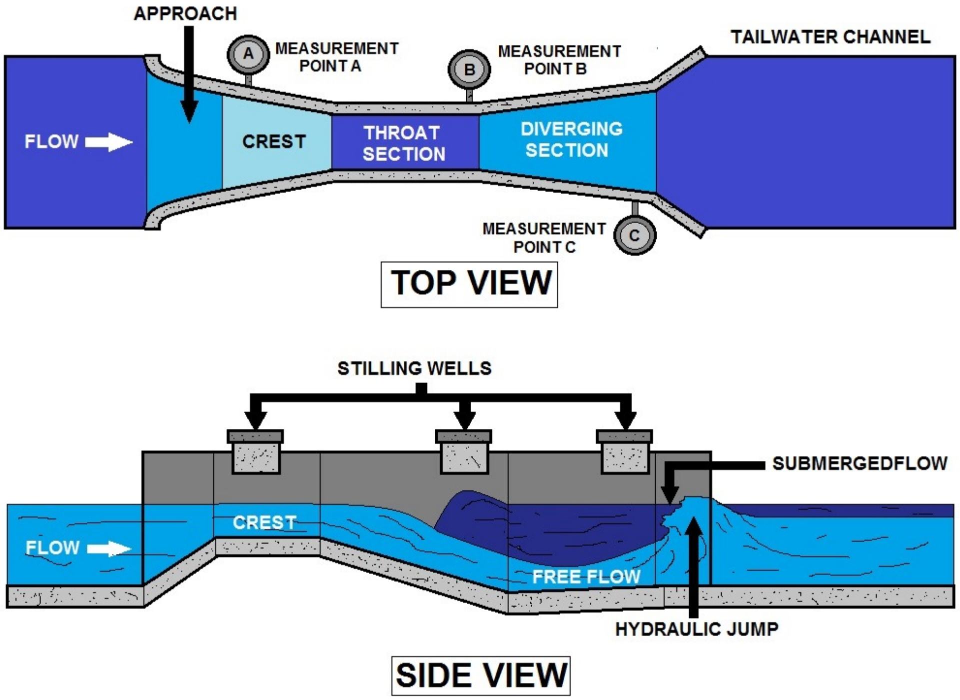
Parshall Flumes are a primary flow element for flow measurement in open channels. The big advantages of Parshall Flumes are their self-cleaning capabilities, low head loss, single-head measurement, and wide operating range.

While commonly used in rectangular channels, they can also be adapted for use in circular channels. Flumes feature stiffening ribs, braces and anchor clips. Options include stilling well, staff gauge, flow sensors, adaptors, etc.

Clarification

Clarification on category-specific wastestream classifications may be provided by consulting the applicable regulation(s) and associated development documents, since wastestream types are addressed in the effluent guideline and categorical standard development process. When in doubt, the Control Authority can always require the CIU to monitor the wastestream(s) in question to quantify the presence (or lack thereof) of categorically regulated pollutants.

Reasonably accurate flow data must also be obtained for each wastestream type flowing through the monitoring point to ensure categorical pretreatment standards are adjusted accordingly.



PARSHALL FLUME

Varieties of Flumes

Some varieties of flumes are used in measuring water flow of a larger channel. When used to measure the flow of water in open channels, a flume is defined as a specially shaped, fixed hydraulic structure that under free-flow conditions forces flow to accelerate in such a manner that the flow rate through the flume can be characterized by a level-to-flow relationship as applied to a single head (level) measurement within the flume.

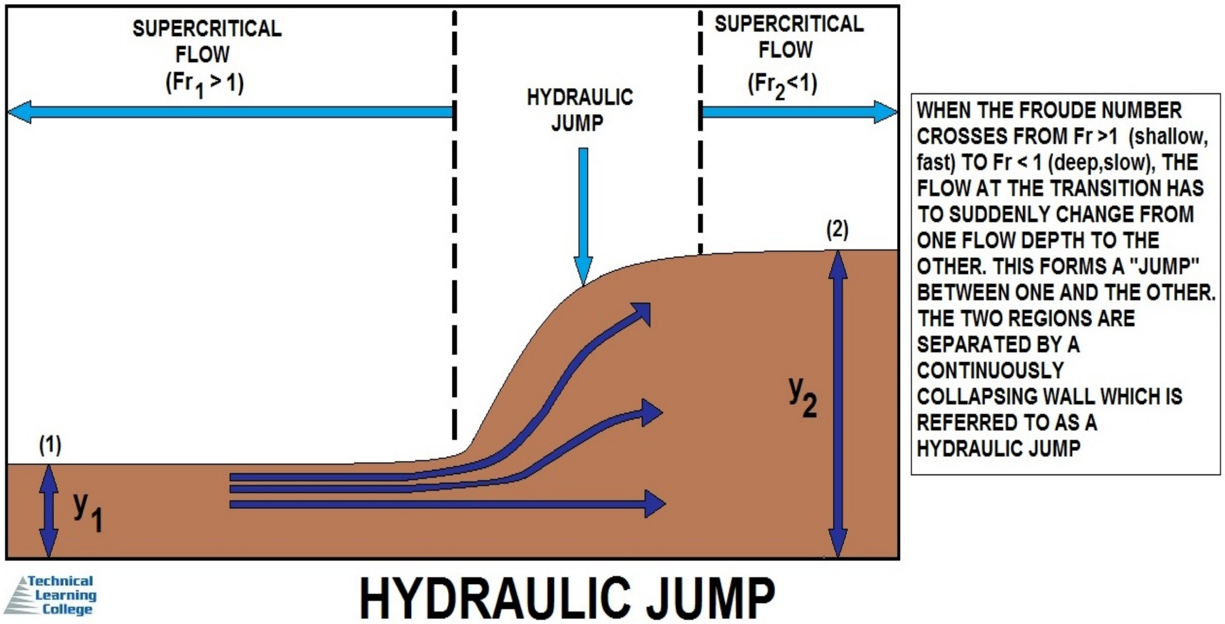
Acceleration is accomplished through a convergence of the sidewalls, a change in floor elevation, or a combination of the two.

Flow measurement flumes typically consist of a converging section, a throat section, and a diverging section. Not all sections, however, need to be present. In the case of the Cutthroat flume, the converging section directly joins the diverging section, resulting in a throat section of no length (hence the term "Cutthroat").

Other flumes omit the diverging section (Montana and HS / H / HL -flumes). Flumes offer distinct advantages over sharp-crested weirs:

- For the same control width, the head loss for a flume is about one-fourth of that needed to operate a sharp-crested weir
- The velocity of approach is part of the calibration equations for flumes
- Unauthorized altering of the dimensions of constructed flumes is difficult (and therefore unlikely)
- Most flume styles readily allow for the passage of sedimentation and floating debris – reducing the time and effort associated with maintaining a flume installation

Hydraulic Jump



A hydraulic jump is a phenomenon in the science of hydraulics which is frequently observed in open channel flow such as rivers and spillways. When liquid at high velocity discharges into a zone of lower velocity, a rather abrupt rise occurs in the liquid surface. Hydraulic jump is the jump or standing wave formed when the depth of flow of water changes from supercritical to subcritical state.

Applicable Equations
Froude Number: $Fr = V/\sqrt{(gL)}$
Where: Fr = Froude number V = Velocity g = gravity L = depth of flow

Critical Flow Depth: $yc = (y_1/2)(\sqrt{(1+8Fr_1^2)}-1)$
Where: yc = critical flow depth y_1 = upstream measured depth Fr = Froude number

Upstream Energy Level: $E_1 = y_1 + (V_1^2/2g)$
Where: E_1 = upstream energy level V_1 = Velocity upstream y_1 = upstream measured depth g = gravity

Head Loss: $hL = (y_2-y_1)^8/(4y_1y_2)$
Where: hL = head loss in the hydraulic jump y_1 = upstream measured depth y_2 = downstream measured depth

Wastestream Types

Regulated
Wastewater from an industrial process that is regulated for a particular pollutant by a categorical pretreatment standard.

Nonregulated, Unregulated
Wastestreams from an industrial process that are not regulated for a particular pollutant by a categorical pretreatment standard and are not defined as a dilute wastestream, e.g.:

< a process wastestream for which categorical standards have been promulgated but for which the deadline for compliance has not yet been reached.

< a process wastestream that currently is not subject to categorical pretreatment standards

< a process wastestream that is not regulated for the pollutant in question but is regulated for other pollutants.

Dilute
Wastestreams which have no more than trace or non-detectable amounts of the regulated pollutant. Defined in 40 CFR § 403.6(e)(1) of the General Pretreatment Regulations to include sanitary wastestreams, demineralized backwash streams, boiler blowdown, noncontact cooling water, storm water, and process wastestreams from certain standards based on the findings that these wastewaters contained none of the regulated pollutant or only trace amounts of it.

The EPA's *Guidance Manual for the Use of Production Based Pretreatment Standards and the Combined Wastestream Formula* should be consulted for more information on the proper application and adjustment of categorical pretreatment standards.

Although categorical standards are established based on a particular industrial category, the EPA provides several options for unique circumstances that justify adjustment of categorical standards for an individual facility:

Proper Application of the CWF or FWA will result in:

- alternative limits being established for each regulated pollutant in each regulated process;
- both daily maximum and long-term average (i.e., 4-day, 30-day, or monthly) alternative limits being calculated for each regulated pollutant;

SECONDARY TREATMENT STANDARDS

The biological treatment component for a municipal wastewater treatment plant is termed **secondary treatment**, and is usually preceded by simple settling (primary treatment). Secondary treatment standards have been established by U.S. EPA for publicly-owned treatment works (POTWs) and reflect the performance of secondary wastewater treatment plants. These technology-based regulations apply to all municipal wastewater treatment plants and represent the minimum level of effluent quality attainable by **secondary treatment**, as reflected in terms of 5-day biochemical oxygen demand (BOD5) and total suspended solids (TSS) removal.

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METHOD DETECTION LIMIT OR MDL

The **Method Detection Level (MDL)** is the basic measure of whether a pollutant or parameter has been detected. It's the minimum concentration at which we can be confident that the effluent concentration is greater than zero. The **MDL** is dependent upon the analytical method used for the pollutant. A sensitive analytical method will typically have a lower **MDL** and can provide more accurate results. In general, if the reported pollutant concentration is less than three times the magnitude of the **MDL**, the accuracy or reliability of these results is questionable, and permit decisions using data in this range should be avoided if possible.

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PRETREATMENT OBJECTIVES

The **Pretreatment Program** is to control the pollutants discharged into sewer systems and to **reduce the amount of pollutants released into the environment**. Most POTWs are designed to treat sanitary (domestic) wastes from households, but not to treat toxic pollutants from industrial or commercial facilities. The toxic pollutants from industrial and commercial facilities may cause serious problems at POTWs. These problems may be prevented by recycling, waste minimization, chemical substitution, pretreatment, or other best management practices to reduce or eliminate the pollutants from commercial or industrial facilities.

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CHECKLIST EXAMPLE FOR ASSESSMENT OF PERMANENTLY INSTALLED FLOWMETERS

INSPECTOR NAME:		DATE:
COMPANY NAME:		TYPE OF PRIMARY DEVICE:
SITE CODE #		SIZE:
ADDRESS:		
DIMENSIONS OF VAULT:	DEPTH OF VAULT:	

TAKE PHOTOGRAPHS

1. IS FLUME LEVEL?

2. HEIGHT MEASUREMENT FROM TOP OF FLUME TO BOTTOM OF PERMANENT TRANSDUCER:

3. HOW HIGH DOES THE LEVEL GET IN FLUME?

4. DAILY MAXIMUM FLOW (CONVERTED TO LEVEL):

5. CAN YOU SETUP OUR TRANSDUCER UNDER OR NEXT TO THEIRS, WITHOUT DISTURBING THEIRS?

6. IS THEIR PERMANENT TRANSDUCER SETUP OVER THE PROPER MEASURING POINT ON THE FLUME?

7. RECORD ANY PROBLEMS WITH THE WAY THE PERMANENT TRANSDUCER / FLOWMENTER IS SETUP:

8. COMMENTS____

Permittee's Flow Measurement System

Four basic steps are involved in evaluating the permittee's flow measurement system:

- Physical inspection of the primary device
- Physical inspection of the secondary device and ancillary equipment
- Flow measurement using the primary/secondary device combination of the permittee
- Certification of the system using a calibrated, portable instrument

Facilities with a closed pipe flow measurement system present a challenge to the inspector. Have the facility personnel explain the operation of the system and how they calibrate the flow measurement system.

Check if it is calibrated yearly at a minimum. It is suggested that the facility conduct periodic monthly checks of the flow measurement system.

The inspector can do a calibration of the closed pipe flow measurement systems in the following ways:

1. If an open-channel primary device is maintained at the facility the inspector can obtain an instantaneous head reading to verify the accuracy of the closed channel flow measuring system. Flow should be within ±10 percent of the closed channel system.

2. The inspector can use a portable flow meter (usually consists of two strap-on sensors that mount on the pipe and utilize the Doppler principle) to verify the accuracy of the facility's flow measurement system by conducting side-by-side comparisons. Flow should be within ±10 percent.

3. Confirm that the calibration procedure demonstrated by the facility's calibration personnel is adequate. The following sections present procedures for inspecting the more common types of primary and secondary devices, for measuring flow using common permanent and portable systems, and for evaluating flow data.

Please note that the number of primary/secondary device combinations is limitless; therefore, it is not feasible to provide procedures for all systems. When encountering systems other than those discussed here the inspector should consult the manufacturer's manual or facility personnel for advice on how the flow-measurement system operates before preparing a written inspection procedure.

2.13 Removal Credits *(Credit USEPA)*

40 CFR §403.7 details the conditions by which a Control Authority may demonstrate consistent removal of pollutants regulated by categorical standards at their POTW, and in so doing, may extend removal credits to industries on a pollutant-specific basis to prevent redundant treatment. Removal credits are available for a pollutant if the pollutant is regulated by the sewage sludge use or disposal option employed by the POTW making the application request, or if the pollutant is listed in 40 CFR Part 403, Appendix G.

In addition, the availability of removal credits is not limited to Appendix G pollutants for POTWs that dispose of sewage sludge in municipal solid waste landfills. Steps for developing such a request are in the EPA's *Guidance Manual for the Preparation and Review of Removal Credit Application*s.

Fundamentally Different Factors Variance Section 301(n) of the CWA authorizes adjustments of categorical pretreatment standards for existing sources who demonstrate they have factors which are fundamentally different from the factors the EPA considered during standards development (40 CFR §403.13).

Variance requests must be based solely on information and data submitted during the development of the categorical standards and the adjusted effluent limitations must be neither more nor less stringent than justified by the fundamental difference nor result in a non-water quality environmental impact markedly more adverse than the impact considered by the EPA when developing the categorical standard.

Successful requests must detail factors well outside the range considered by the EPA in establishing the standard and not merely factors deviating from the average. Further, differences must not be similar to a significant number of other facilities in the category. A facility must request a variance in writing no later than 180 days after publication of a categorical Pretreatment Standard in the Federal Register.

Net/Gross Adjustment Categorical Pretreatment Standards
Net/Gross Adjustment Categorical pretreatment standards can be adjusted to reflect the presence of pollutants in a CIU's intake waters (40 CFR §403.15). To obtain a net/gross credit, the CIU must submit a formal written request to the Control Authority that demonstrates:

- ➢ Its intake water is drawn from the same body of water that the POTW discharges into (this can be waived if the Control Authority finds no environmental degradation will result);
- ➢ The pollutants present in the intake water will not be entirely removed by the treatment system operated by the CIU; and
- ➢ The pollutants in the intake water do not vary chemically or biologically from the pollutants limited by the applicable standard.

Inherent in this provision is the requirement that the CIU employ a treatment technology capable of meeting the categorical pretreatment standard(s). Net/gross adjustments should not be granted to CIUs that have no treatment. Further, credits are only granted to the extent necessary to meet the applicable standard(s), up to a maximum value equal to the influent value.

Innovative Technology--in accordance with 307(e) of the CWA, existing CIUs choosing to install an innovative treatment system may receive approval from the Control Authority for up to a two year extension to their applicable categorical pretreatment standards compliance deadline, provided:

- The innovative treatment has a reasonable potential to result in significantly greater pollutant removal or equivalent removal at a substantially lower cost than the technologies considered by the EPA when developing the categorical standard;
- The innovative technique has the potential for industry-wide application; and
- The proposed compliance extension will not cause or contribute to the violation of the POTW's NPDES permit.

While policy has been established for universal categorical variance requests, occasionally, a Control Authority may merely need assistance to classify a CIU and/or to determine applicable categorical limitations. Provisions in the General Pretreatment Regulations allow POTWs and IUs to request an EPA category determination for a specific IU within 60 days after the effective date of the standard in question [40 CFR §403.6(a)].

Even after the formal timeframe for requesting a categorical determination, the EPA (and states) will assist POTWs and IUs with categorization issues. Such requests, however, do not affect applicable reporting requirements, including timely requests submitted under 40 CFR §403.6(a). Additionally, the EPA has addressed universal CIU questions posed by Control Authorities in various memoranda and guidance:

Research and Development (R&D) Facilities
Unless specifically addressed in the categorical regulation or associated development document, R&D facilities where there is no commercial sale of products from the facility, are not subject to categorical standards.

Should an R&D facility need pollution controls to comply with prohibited discharge standards and/or local limits, the development documents may serve as guidance on the performance of pollution control technologies.

Certification Statements
In lieu of requiring self-monitoring, some standards allow CIUs to certify that they do not use, generate or discharge a regulated pollutant [e.g. Pulp, Paper and Paperboard facilities can certify that chlorophenolic compounds are not used (40 CFR Part 430) and Pharmaceutical Manufacturing facilities can certify that cyanide is not used or generated (40 CFR Part 439)]. Facilities providing such certifications are still considered CIUs, and therefore are subject to other pretreatment standards and requirements.

Lack of specific categorical effluent limitations IUs subject to PSES or PSNS that merely require compliance with 40 CFR Part 403 are not considered CIUs. However, these users may still be classified as SIUs and are still subject to the general and specific prohibitions and any local limits.

2.14 Total Toxic Organics (TTO) *(Credit USEPA)*

Seven categorical regulations currently limit the discharge of TTO:

- **40 CFR Part 413 - Electroplating**
- **40 CFR Part 433 - Metal Finishing**
- **40 CFR Part 464 - Metal Molding and Casting**
- **40 CFR Part 465 - Coil Coating**
- **40 CFR Part 467 - Aluminum Forming**
- **40 CFR Part 468 - Copper Forming**
- **40 CFR Part 469 - Electrical and Electronic Components (Phase I and II)**

For each of these standards, TTO refers to the sum of the masses or concentrations of certain toxic organic pollutants found in the regulated discharge at a concentration greater than 0.01 milligrams per liter (mg/l).

However, the toxic organic pollutants regulated by the TTO limit are specific to each industrial category. Further, industrial categories may provide some flexibility with regard to monitoring and/or reporting requirements as follows:

40 CFR Parts 413 and 433 allow development and implementation of a Toxic Organic Management Plan (TOMP) in lieu of routine monitoring while 40 CFR Part 469 allows development and implementation of a Solvent Management Plan.

Upon approval of these plans by the Control Authority, the CIU can demonstrate compliance with TTO requirements by certifying that the facility is adhering to this Plan to prevent organics from being discharged to the POTW. A specific certification statement must be signed and provided to the Control Authority on a regular basis.

40 CFR Parts 464, 465, 467, and 468 allow an option to demonstrate compliance with an Oil and Grease limit in lieu of demonstrating compliance with a TTO limit. The option chosen by the CIU must be utilized for all reports required (i.e., BMR, 90-daycompliance report, and periodic compliance reports).

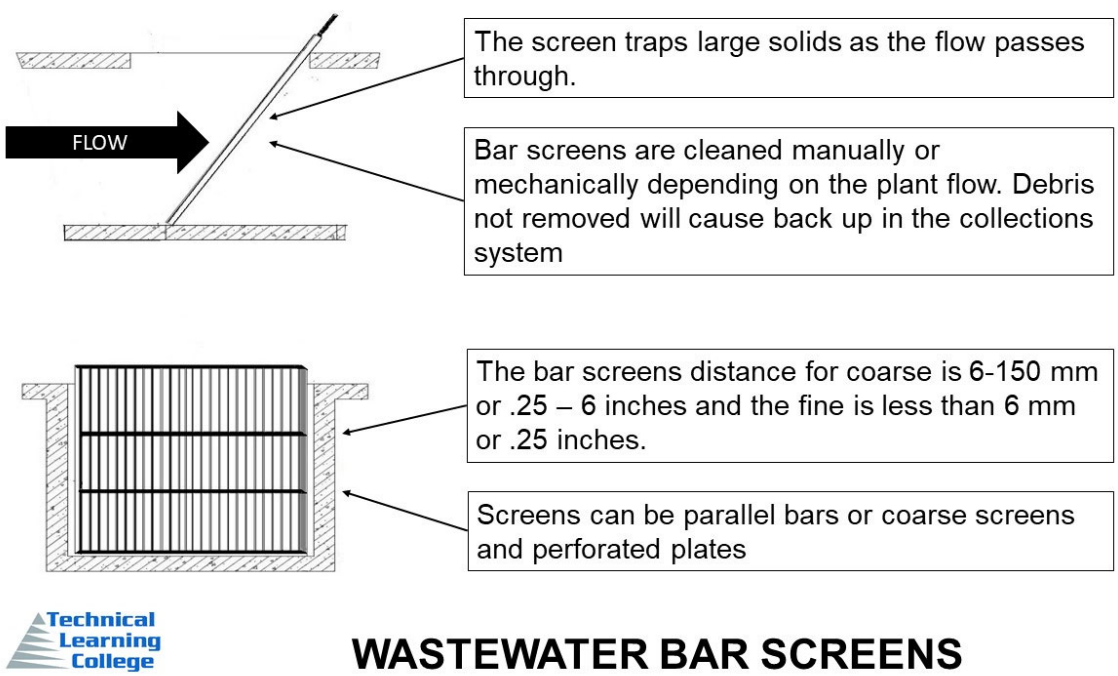
The EPA's *Guidance Manual for Implementing Total Toxic Organics (TTO) Pretreatment Standards* should be consulted for more information on TTO.

2.15 MAHL MAIL Introduction *(Credit USEPA)*

Maximum Allowable Headworks Loading Method (MAHL)
Pollutant by pollutant, treatment plant data are used to calculate removal efficiencies, before applying the most stringent criteria (i.e., water quality, sludge quality, NPDES permit, or pollutant inhibition levels) to back-calculate the MAHLs. Subtracting out contributions from domestic sources, the available industrial loading is then either evenly distributed among the IUs, or allocated on an as needed basis to those IUs discharging the pollutant above background levels.

Maximum Allowable Industrial Load (MAIL)
The MAIL is the total daily mass that a POTW can accept from all permitted IUs and ensure the POTW is protecting against pass through and interference.

Headworks' "Rotating Barscreens"



2.15.1 More on Local Limits *(Credit USEPA)*

Prohibited discharge standards are designed to protect against pass-through and interference generally. Categorical pretreatment standards, on the other hand, are designed to ensure that IUs implement technology-based controls to limit the discharge of pollutants. Local limits, however, address the specific needs and concerns of a POTW and its receiving waters.

Federal regulations at 40 CFR §§403.8(f)(4) and 122.21(j)(4) require Control Authorities to evaluate the need for local limits and, if necessary, implement and enforce specific limits as part of pretreatment program activities. Local limits are developed for pollutants (e.g. metals, cyanide, BOD5 TSS, oil and grease, organics) that may cause interference, pass through, sludge contamination, and/or worker health and safety problems if discharged in excess of the receiving POTW treatment plant's capabilities and/or receiving water quality standards.

Typically, local limits are developed to regulate the discharge from all IUs, not just to CIUs, and are usually imposed at the "end-of-pipe" discharge from an IU (i.e., at the point of connection to the POTW's collection system). In evaluating the need for local limit development, it is recommended that Control Authorities:

- Conduct an industrial waste survey to identify all IUs that might be subject to the pretreatment program;
- Determine the character and volume of pollutants contributed to the POTW by these industries;
- Determine which pollutants have a reasonable potential for pass through, interference, or sludge contamination;
- Conduct a technical evaluation to determine the maximum allowable POTW treatment plant headworks (influent) loading for at least arsenic, cadmium, chromium, copper, cyanide, lead, mercury, nickel, silver, and zinc (Figure19);
- Identify additional pollutants of concern;
- Determine contributions from unpermitted sources to determine the maximum allowable treatment plant headworks loading from "controllable" industrial sources (Figure 20);
- Implement a system to ensure these loadings will not be exceeded.

Other local limit approaches available to Control Authorities include:
Collection System Approach Pollutants found to be present which may cause fire and explosion hazards or other worker health and safety concerns, are evaluated for their propensity to volatilize and are modeled to evaluate their expected concentration in air. Comparisons are made with worker health exposure criteria and lower explosive limits.

Where values are of concern, the Control Authority may set limits or require development of management practices to control undesirable discharges. The collection system approach may also consider the prohibition of pollutants with specific flashpoints to prevent discharges of ignitable wastes. The EPA's *Guidance to Protect POTW Workers from Toxic and Reactive Gases and Vapors* details strategies for developing such local limits.

Industrial User Management Practice Plans
These plans typically consist of narrative local limits requiring IUs to develop management practices (e.g., chemical management practices, best management practices, and spill prevention plans) for the handling of chemicals and wastes. The need for and suggested contents of such plans may be found in the EPA's *Control of Slug Loadings to POTWs: Guidance Manua*l, and *Spill Prevention, Control, and Countermeasure (SPCC) Information Guid*e.

2.16 Case-by-Case Discharge Limits *(Credit USEPA)*

These numeric local limits are based on best professional judgment (**BPJ)** and available pollution prevention and treatment technologies that are known to be economically feasible. This approach is most often used when insufficient data are available to employ the methods outlined above.

Local Specific Prohibitions
POTW specific prohibitions may be imposed in addition to the prohibitions detailed in 40 CFR § 403.5 (a) & (b) to address hydraulic, pollutant specific, and/or aesthetic concerns; e.g.:

- Noxious or malodorous liquids, gases, or solids creating a public nuisance.
- Wastestreams that impart color and pass through the POTW treatment plant.
- Storm water, roof runoff, swimming pool drainage.
- Wastewaters containing radioactive wastes or isotopes.
- Removed substances from pretreatment of wastewater.

Regardless of the approaches taken by a Control Authority, local limits should correct existing problems, prevent potential problems, protect the receiving waters, improve sludge use options, and protect POTW personnel. Additional existing EPA guidance on the subject includes:

- *Guidance for Preventing Interference at POTWs*
- *Guidance Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program*
- *Supplemental Manual on the Development and Implementation of Local Discharge Limitations Under the Pretreatment Program: Residential and Commercial Toxic Pollutant Loadings and POTW Removal Efficiency Estimation*
- *Toxicity Identification Evaluation: Characterization of Chronically Toxic Effluent*s.

Additionally, many EPA Regions and States have developed local limits guidance to address regional and state issues.

LOCAL LIMITS OBSERVATION SHEET *Example*

SITE DESCRIPTION:

SITE CODE #: **DATE:**

TIME	pH	TEMP.	RES.CL_2	INITIALS
0900				
1200				
1430				
1700				
2000				
2230				
0100				
0430				

DAILY TOTAL FLOW:

PICKLE JAR IW#	
FIELD COMP IW#	
VOC's IW#	

TPH IW#			

SAMPLES COLLECTED

PARAMETER	YES	NO	PARAMETER	YES	NO
601/602 (HOW MANY)			BOD, COD, TSS		
8240 (HOW MANY)			NO_2/NO_3		
SULFIDES			METALS		
TKN			608		
AMMONIA (NH_4)			1657		
CN			625		
TPH (HOW MANY)			8270		
8140			8080		

IF NO SAMPLE COLLECTED, RECORD ON BACK AS TO WHY.

2.17 Summary of Standards

A summary of all of the pretreatment standards, including general and specific prohibitions, categorical pretreatment standards, and local limits.

	General and Specific Prohibitions	Categorical Pretreatment Standards	Local Limits
Development	Established at the Federal level	Established at the Federal level	Developed by Control Authorities
Reference	40 CFR 403.5(a) & (b)	40 CFR Parts 405-471	Requirements for development found in 40 CFR §§403.5(c) & 403.8(f)(4)
Applicability	All IUs	CIUs	Commonly all IUs or all SIUs, but depends on allocation method used when developing limits.
Purpose	Provide for general protection of the POTW. May be superseded by more stringent categorical pretreatment standards or local limits.	Minimum standards based on available treatment technology and pollution prevention measures for controlling non-conventional and toxic pollutants that may cause pass through, interference, etc. at the POTW. May be superseded by more stringent local limits.	Provide site specific protection for a POTW and its receiving waters. May be superseded by more stringent categorical standards.

All standards are considered pretreatment standards for the purpose of section 307(d) of the Clean Water Act. A POTW is responsible for identifying standard(s) applicable to each industrial user and applying the most stringent requirements where multiple provisions exist. Compliance with imposed standards can be achieved through implementation of best management practices, development of a pollution prevention program, and/or installation of pretreatment.

You must abide by your permit requirements and not deviate from them based on information presented in this course.

CATEGORICAL STANDARDS

Categorical standards are technology-based limitations on pollutant discharges to POTWs, which have been promulgated by U.S. EPA in accordance with Section 307 of the Clean Water Act, and apply to specific process wastewater discharges for thirty-two (32) different industrial categories. (Categorical standards can be found in 40 CFR Parts 405-471.) Categorical standards are similar to federal effluent guidelines (FEGs), with two important distinctions:

- **categorical standards** apply to indirect discharges while FEGs apply only to direct discharges to surface waters; and

- **categorical standards** are developed with the assumption that the POTW will remove at least small amounts of a pollutant, therefore the categorical standard for the pollutant will be less stringent than the corresponding best available technology (BAT) limits for the FEG applied to a direct discharger

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Topic 2 - Pretreatment Program Development Post Quiz

1. States with approved pretreatment programs are responsible for overseeing and coordinating the development and approval of local pretreatment programs. Before state approval is obtained, EPA is the Approval Authority for local pretreatment programs. True or False

2. NPDES states must receive EPA approval before they may function as Approval Authorities for pretreatment purposes. The conditions for approval are found at 40 CFR 403.10. Before this approval, EPA serves as the pretreatment Approval Authority, even where the state issues NPDES permits. True or False

3. EPA's General Pretreatment Regulations require POTWs to use a control mechanism that ensures that SIUs meet all applicable Pretreatment Standards and Requirements.
True or False

4. The federal regulations state that POTWs can use permits, orders, or other similar means to control SIUs' discharges; it is EPA's experience that the permit is the least effective means of ensuring that industrial users are ignorant of all applicable pretreatment requirements.
True or False

5. Regardless of the type of control mechanisms the POTW uses, each control mechanism issued to an SIU must contain all the maximum federal requirements. True or False

Individual Permits or General Control Mechanisms

6. An SIU permit is effective for a lifetime and is irrevocable by the issuing. In addition, the Control Authority's legal authority will typically include a provision that allows the discharge of industrial wastewater from an SIU without a current Industrial User permit. True or False

At a minimum, it must include the following [40 CFR 403.8(f)(2)]:

7. Prohibited discharge standards and applicable categorical standards, local limits.
True or False

8. Effluent limits (including Best Management Practices [BMPs]) that are based on applicable general Pretreatment Standards, non-categorical Pretreatment Standards, special sampling, and state and local law. True or False

9. Requirements to control slugs if determined by the pesticide authority to be necessary
True or False

10. In many Industrial User permit programs, permittees are given an opportunity to review and comment on draft permits or challenge permit terms administratively within a specified period. If the permit is not challenged upon issuance, or if all opportunities for challenge of the final permit are exhausted, in most states, it becomes binding on the permittee.
True or False

POTW Pretreatment Program Requirements

11. The actual requirement for a POTW to develop and implement a local pretreatment program is a recommendation of the CWA. True or False

12. Once approved, the Approval Authority oversees POTW pretreatment program implementation via receiving annual reports and conducting periodic audits and inspections.
True or False

Who Issues Permits?

13. In states with approved state pretreatment programs, the state may not assume responsibility for implementing POTWs' local pretreatment programs [40 CFR 403.10(e)]. In such cases, the state is the Industrial Users and is required to issue Industrial User permits or other authorized control mechanisms to the Control Authority. True or False

Why Permits are Recommended

14. A permit system provides a mechanism for the Control Authority to control the discharges of Industrial Users to the POTW through an administrative process that facilitates understanding of Pretreatment Standards and Requirements. The permitting process allows the Control Authority to clearly communicate and address issues with an Industrial User before permit issuance.
True or False

Permittee's Responsibilities

15. Permits are also easily enforced, provided that permit conditions are written clearly and concisely and require specific actions on the part of the Industrial User.
True or False

Permit Issuance Process

16. Before a Control Authority can begin issuing individual tickets or general control mechanisms to the public, it must have adequate legal authority to do so, and makes up these rules, decisions regarding how to identify possible customers, who will be required to obtain permits, when permits will be issued, the effective period or duration for permits, and the circumstances under which a permit may be modified or terminated can be made-up.
True or False

Control Authority

17. The General Pretreatment Regulations define the term "Control Authority" as a POTW that administers an approved pretreatment program since it is the entity authorized to control discharges to its system. True or False

Enforcement Response Plan (ERP)

18. The POTW must develop and implement an ERP that contains detailed procedures indicating how the POTW will investigate and respond to instances of IU noncompliance. True or False

Significant Industrial Users and therefore require a discharge permit if the user:

19. Is subject to the Environmental Protection Agency's Categorical Pretreatment Standards. Categorical users receive decreased scrutiny due to their potential to pollute. Examples of categorical users are metal and pharmaceutical retail sales. True or False

Categorical Pretreatment Standards

20. Categorical pretreatment standards (i.e., categorical standards) are arbitrary-based standards that apply to discharges to POTWs from all industrial categories (i.e., indirect dischargers) and limit the discharge of specific pollutants. True or False

Topic 3 - Identifying Industrial Users

Topic 3 - Section Focus: You will learn the basics of identifying and locating all possible Industrial and Commercial Users, which might be subject to your POTW's Pretreatment Program and inspection procedures. At the end of this section, you will be able to understand and describe pretreatment industrial and commercial users. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 3 – Scope/Background: The introduction of pollutants into a POTW from any non-domestic source IUs or CIUS is regulated under section 307(b), (c), or (d) of the Act. Subject to Federal categorical standards. Discharges 25,000 GPD or more of process wastewater. Contributes 5% or more of hydraulic or organic capacity of the POTW treatment plant. Has a reasonable potential for adversely affecting the POTW or for violating any standard or requirement.

- PRIORITY POLLUTANTS
- PHARMACEUTICALS
- HEAVY METALS
- BIODEGRADABLE SOLIDS
- DISSOLVED INOGANICS
- NUTRIENTS
- SOLIDS
- PATHOGENS AND PARASITES

Technical Learning College **WASTEWATER TREATMENT OVERLOAD INDICATORS**

Section 3.1 Identifying Industrial Users

The Control Authority is required to establish and implement procedures for identifying Industrial Users as part of its program responsibilities [40 CFR 403.8(f)(2)]. The industrial community must be accurately identified by the Control Authority. The Control Authority must prepare and maintain a list of industrial users as part of the approved POTW Pretreatment Program [40 CFR 403.8(f)(6)]. Consequently, an Industrial Waste Survey is a useful tool to first identify and characterize industrial discharges to the POTW treatment plant.

Below are additional methods frequently incorporated into the POTW procedures in order to maintain the list:

- A requirement that new industries fill out applications for discharge when they apply for business licenses
- Communications with other city departments (i.e., water, utilities, health and safety, and building departments) concerning new industries in the POTW service area
- Continual review of business license records or other standard listings of industrial firms, such as Chamber of Commerce rosters or the telephone directory
- Ongoing inspection and monitoring activities
- Periodic expiration of permits and subsequent reapplication by permit holders
- Periodic mailing of a survey questionnaire to the industry accompanied by a request to update the information

The Control Authority must submit to the Approval Authority an updated list of its Industrial Users at least annually [40 CFR 403.12(i)]. In addition to programmatic requirements expressed in the General Pretreatment Regulations at 40 CFR Part 403, POTWs should also be aware of the requirement to identify their Industrial Users as part of their POTW NPDES Permit application [40 CFR 122.21(j)(6) and (7)] and also to report any new or substantially changed pollutant introduced during the NPDES Permit term [40 CFR 122.42(b).]

3.1.1 Legal Authority (Credit USEPA)

POTWs seeking pretreatment program approval must develop policy and procedures for program implementation and establish the legal authority to implement and enforce program requirements. The General Pretreatment Regulations do not provide Control Authorities with the legal authority to carry out their pretreatment programs; rather, the regulations set forth the minimum requirements for POTWs with pretreatment programs.

A Control Authority's legal authority actually derives from State law. Therefore, State law must confer the minimum Federal legal authority requirements on a Control Authority. Where deficient, State law must be modified to grant the minimum requirements. In order to apply regulatory authority provided by State law, it is generally necessary for the Control Authority to establish local regulations to legally implement and enforce pretreatment requirements. Where the Control Authority is a municipality, legal authority is detailed in a Sewer Use Ordinance (SUO), which is usually part of city or county code.

Regional Control Authorities frequently adopt similar provisions in the form of "**rules and regulations**." Likewise, State agencies implementing a Statewide program under 40 CFR §403.10(e) set out pretreatment requirements as State regulations, rather than as an SUO. **[Local regulations cannot give the Control Authority greater authority than that provided by State law.]**

The EPA's 1992 guidance, EPA Model Pretreatment Ordinance provides a model for POTWs that are required to develop pretreatment programs. As POTW service areas expand, new contributions may arise from "**extra jurisdictional**" IUs located outside of the Control Authority's legal jurisdiction.

Multijurisdictional arrangements require special legal/contractual mechanisms to ensure adequate authority to implement and enforce program requirements in these other jurisdictions. Some state statutes may provide for general extraterritorial powers (i.e., a Control Authority is automatically allowed to regulate extra jurisdictional IUs contributing to their system).

However, the extent to which authorities (i.e., to permit, inspect, enforce, monitor, etc.) are granted may be somewhat limited, thereby, restricting a Control Authority's ability to implement and enforce a program. Where obtaining authority from the State to regulate extra jurisdictional IUs is not feasible, other options may be pursued:

Districts
The creation of an independent organization (by affected municipalities or the State) which is authorized to administer and enforce an approved pretreatment program for the entire area in which it provides services is common in areas where multiple POTWs each serve various jurisdictions.

Agreements
Affected Control Authorities may opt to enter into agreements requiring each municipality to implement and enforce the approved pretreatment program covering all IUs within their jurisdiction. The Control Authority must retain the means to regulate extra jurisdictional IUs where the contributing jurisdiction's efforts are inadequate. It is essential that agreements clearly define the roles of each party.

Annexation
Where extra jurisdictional IUs lie in unincorporated areas, a Control Authority may annex or utility annex the service area.

Contracts
A Control Authority may enter into a contract with an extra jurisdictional IU, although contracts generally limit the enforcement capabilities of the Control Authority. As such, contracts should only be pursued when all other means fail. Since procedures for obtaining jurisdiction, creating sanitary districts, annexing service areas, etc. vary among states, Control Authority personnel should consult with their legal staff to thoroughly examine options allowed. This may include requesting State legislative changes if necessary. The EPA's 1994 Multijurisdictional Pretreatment Programs - Guidance Manual provides more information on these jurisdictional issues, including sample language for agreements and contracts.

3.1.2 Industrial Waste Surveys *(Credit EPA)*

As part of program development and maintenance, the Federal regulations [40 CFR §403.8(f)(2)(I)] require Control Authorities to identify and locate all IUs that might be subject to the pretreatment program. While the General Pretreatment Regulations do not specify how a Control Authority is to accomplish this, it is beneficial to conduct an initial in-depth survey, and then institute measures to update the list continuously.

Control Authorities must ensure that the entire service area is reviewed. This may include IUs located outside the jurisdictional boundaries of the POTW. In these instances, it may be appropriate to solicit assistance from other jurisdictions in developing the list of potential dischargers. The types of resources that may be consulted in compiling and updating the master list include:

- Water and sewer billing records
- Applications for sewer service
- Local telephone directories
- Chamber of Commerce and local business directories
- Business license records
- POTW and wastewater collection personnel and field observations
- Business associations
- Internet

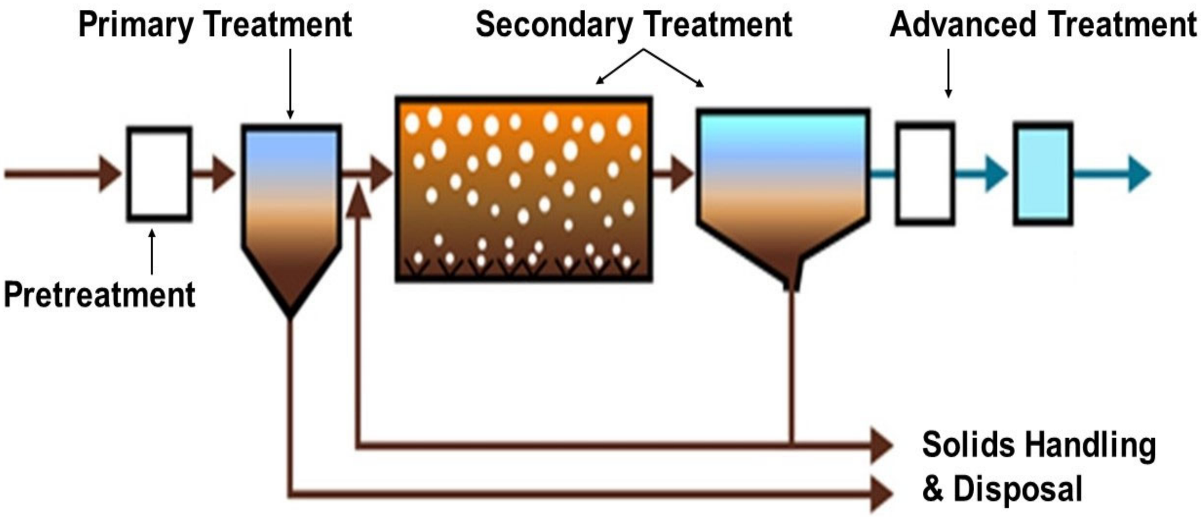
Once IUs are identified, the Control Authority must classify these users to determine if pretreatment standards and requirements should apply to these facilities. Typically, the Control Authority develops and distributes an Industrial Waste Survey (IWS) questionnaire to the identified IUs. The IWS questionnaire requests information regarding IU activities and the nature of wastes discharged.

The Control Authority may opt to send a detailed IWS questionnaire initially or conduct the survey in two phases (i.e., send a screener requesting basic information to eliminate obvious facilities and then send a detailed IWS to those facilities with greater potential to be SIUs).

Key to the IWS is to identify facilities that are subject to categorical standards (i.e., CIUs) or otherwise have the potential to impact the POTW (i.e., SIUs). A POTW's IU inventory should include the name, location, classification, applicable standards, basis for limits imposed, and volume of discharge, control mechanism status, compliance dates and other special requirements for each IU.

The IWS should provide most of the information required to develop the inventory, although some supplementary information might be required from other sources, such as the permit application or monitoring data. The IU inventory must be updated as needed [40 CFR §403.8(f)(2)(I)] and provided to the Approval Authority as part of the annual report requirement (see POTW Reports section in this Chapter).

The ongoing task of maintaining a complete list of IUs requires the Control Authority to implement a system to track existing IU information and/or classification changes and new user information. Some Control Authorities may proactively opt to institute a "utility connect questionnaire" program. These types of forms are completed when a customer applies for new utility service (e.g., water, sewerage, or electricity).



Technical Learning College

WASTEWATER TREATMENT

3.2 Who Needs a Permit?

One of the first decisions to be made when establishing a permit program is to determine which Industrial Users will be required to obtain a permit. At a minimum, EPA requires that permits be issued to all SIUs. The Control Authority must establish a definition of an SIU to clearly establish which Industrial Users are required to apply for and obtain permits to discharge. The Control Authority's definition of SIU must be at least as stringent as the federal definition as listed at 40 CFR 403.3(v).

EPA has defined Significant Industrial Users as the following:

- All Industrial Users subject to categorical Pretreatment Standards under 40 CFR 403.6 and 40 CFR Topic I, subchapter N.—known as Categorical Industrial Users (CIUs).
- Any other Industrial User that discharges an average of 25,000 gallons per day (gpd) or more of process wastewater to the POTW (excluding sanitary, noncontact cooling, and boiler blowdown wastewater); contributes a process wastestream that makes up 5 percent or more of the average dry-weather hydraulic or organic capacity of the POTW treatment plant; or is designated as such by the Control Authority on the basis that the Industrial User has a reasonable potential to adversely affect the POTW's operation; or for violating any Pretreatment Standard or Requirement.

Furthermore, some categorical pretreatment standards require a facility to not discharge certain process wastewaters. For those facilities, the permit writer should evaluate whether there is a potential for the facility to actually discharge the prohibited process wastewater into the POTW. If the facility has no potential (e.g., no sewer connection) of discharging the prohibited wastewater, permit issuance to those users is discretionary.

Similarly, if the facility uses a 100 percent recycling treatment system and has no potential for discharge of the prohibited process wastewater, the facility would also not be considered a CIU. Regardless, CIUs that employ a 100 percent recycling system or claim no discharge of regulated process wastewater should be thoroughly evaluated through an on-site inspection to determine if there is any reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement due to accidental spills, operational problems, or other causes. If the Control Authority concludes that no regulated process wastewater can reach the POTW, and therefore, the facility has no reasonable potential for adversely affecting the POTW's operation or for violating any pretreatment standard or requirement, the facility need not be designated a CIU or an SIU, as defined by 40 CFR 403.3(v).

But if an Industrial User, subject to a federal standard of no discharge of certain process wastewaters or prohibition of discharge of particular pollutants, has a potential to discharge a wastestream that is subject to the federal standard, the user must be considered a CIU and, thus, an SIU (at least until a compliance record can be established and the Control Authority can assess if the preconditions for a Nonsignificant Categorical Industrial User (NSCIU) are satisfied. See below regarding NSCIU.). Therefore, these facilities must be permitted. (For a summary of categorical sectors with prohibited discharge requirements, see Appendix G.)

Other factors to consider when determining which additional Industrial Users the Control Authority should permit include the following:

- Pollutants being introduced
- Spill potential
- Slug discharge potential
- Previous compliance history
- Potential for causing the POTW to violate its NPDES permit

• Potential for causing difficulties with sludge use or disposal

The federal Pretreatment Regulations allow, at the Control Authority's discretion, the classification of certain CIUs as nonsignificant and, thus, not subject to permitting. Before implementing this provision, the Control Authority must verify that it is authorized under state law and ensure that the POTW has the legal authority to implement such provision.

As defined in the Pretreatment Regulations at 40 CFR 403.3(v)(2), an NSCIU is a discharger that, among other things, never discharges more than 100 gpd of total categorical wastewater to the POTW and never discharges any untreated concentrated wastes. If an Industrial User is determined to be an NSCIU, the user is no longer an SIU and is therefore not required to be controlled through a permit or other control mechanism although the Control Authority, of course, may choose to do so.

Regardless of whether an Industrial User is determined to be an NSCIU, it is still a categorical discharger and, as such, is still required to comply with applicable categorical Pretreatment Standards and related reporting and notification requirements at 40 CFR 403.12(b), (c), (d), (f), (j), (l), and (p).

Furthermore, the Control Authority still must perform the same minimum oversight of an NSCIU that is required for other facilities that are not SIUs, including notifying the CIU of its status and requirements, reviewing required reports, verifying that daily regulated flow rates do not exceed 100 gpd, random sampling and inspection, and investigating noncompliance as necessary.

3.2.1 Permitting *(Credit USEPA)*

The General Pretreatment Regulations require all IUs be controlled through permit, order, or similar means to ensure compliance with applicable pretreatment standards and requirements. Section 403.8(f)(1)(iii)(A-E) clarifies this requirement to specify that all SIUs be issued a permit or equivalent individual control mechanism which contains, at a minimum:

- Statement of duration (not to exceed five years);
- Statement of nontransferabililty (unless outlined provisions are met);
- Effluent limitations based on applicable standards;
- Self-monitoring, sampling, reporting, notification, and record-keeping requirements;
- Statement of applicable civil and criminal penalties; and a schedule of compliance (where appropriate).

The EPA's 1989 *Industrial User Permitting Guidance Manual* details procedures for drafting IU discharge permits. SIU permits issued are site specific and tailored to the unique circumstances of the IU. Permit conditions must establish clear and explicit requirements for the permittee, to include using such terms such as "shall" and "must" in lieu of vague terms such as "recommend" or "may". The Control Authority must document its decision-making process when developing permits to ensure defensibility and enforceability. Adherence to sound, documented procedures will prevent any arbitrary and capricious claims by the permittee.

Whether developing or reissuing a permit, the permitting process consists of three phases:

Phase I - Collection and verification of information
Phase II - Data interpretation and fact sheet development
Phase III - Permit development and issuance.

Phase I
As part of Phase I, Control Authorities may review and verify information contained in the permit application, perform an inspection of the IU for confirmation of facts, tally data, and potentially sample and analyze the IU's wastestream. Knowledgeable Control Authority personnel, effective communication, and SIU cooperation are essential to collection of complete and accurate information.

Phase II requires that the Control Authority interpret data and other information and document the permit decision-making rationale, preferably in a permit fact sheet. Although the contents of a fact sheet will vary by permittee, fact sheets should provide a justification of all permitting decisions.

Typical components of a fact sheet are provided. Completed fact sheets should be included as part of the permit and provided to the Permittee to document the soundness of permitting decisions. For CIUs:

Components of Permit Fact Sheet

- the basis for the categorical determination(s)
- the identity and flow volume of all wastestreams generated and discharged to the POTW, and classified accordingly (i.e., regulated, unregulated, or dilution)
- data used and/or justification for estimates used to determine categorical limitations
- basis for limits imposed for categorical parameters.

For SIUs/CIUs:

- basis for limits imposed for non-categorical parameters
- rationale for compliance schedules, special plans required, special conditions, etc.
- basis for monitoring and reporting frequencies.

Inspection Considerations *(Credit USEPA)*

- Provide current data on IUs
- Confirm or determine IUs' compliance status
- Determine completeness and accuracy of the IU's performance/compliance records
- Assess the adequacy of the IU's self-monitoring and reporting requirements
- Assess the adequacy of monitoring locations and IU's sampling techniques
- Assess the adequacy of imposed limitations and pollutants of concern
- Develop rapport with IUs
- Evaluate operation and maintenance and overall performance of an IU's pretreatment system
- Assess the potential for spills and slug loadings
- Evaluate the effectiveness of slug control plan
- Reveal issues requiring action
- Identify noncompliance needing resolution
- Suggest pollution prevention opportunities
- Collect samples
- Obtain data to support enforcement actions

After all permitting decisions are made; the Control Authority must incorporate those decisions into a permit. The permit, signed by the specified Control Authority official, is provided to the Permittee for comment and after comments are addressed, a final permit is issued to the IU. While many comments may be easily addressed/resolved by the Control Authority, occasionally resolution must be obtained through a formal adjudicatory hearing process where both the Permittee and Control Authority present their case to a third party.

Non-SIUs
Many POTWs also control contributions from non-SIUs using various means, such as through general permits issued to an entire industrial sector. These types of control mechanisms may not necessarily require compliance with specific pollutant limitations.

For example:

- ✓ Grease trap maintenance and record keeping requirements for food establishments;
- ✓ Maintenance and record-keeping requirements for photo processors' silver reclamation units;
- ✓ Best management practices for mercury recovery by hospitals and dentists.

Once the permitting program has become more firmly established, or if problems with specific pollutants are identified, the Control Authority should consider expanding its program beyond the SIUs, such as waste haulers, restaurants, auto maintenance facilities, and dental and medical facilities.

Consequently, the POTW should also establish the legal authority to issue permits to non-SIUs. For further discussion on permitting waste haulers, see the Guidance Manual for the Control of Wastes Hauled to Publicly Owned Treatment Works.

3.2.2 Permit Application *(Credit USEPA)*

All industrial users that require a permit must be sampled to determine the characteristics of the wastes to be discharged into the POTW's sewer system. Prior to the issuance of a permit for existing industrial users, the POTW's Inspector or Water Quality Department/Pollution Control Division samples the user's effluent, and performs the analyses required by the applicable discharge standards (i.e., Categorical standards or local limits).

For new industrial users, estimates of the wastes to be discharged into the POTW's sewer system must be submitted along with the permit application. No sampling would be performed at these new facilities, since they do not presently discharge wastes into the sewer system.

A four-day sampling program is usually conducted at each site to collect both composite and grab (for pollutants not amenable to composite sampling) samples as needed.

Industrial Sector
Industrial sector general permitting programs are common where a real or potential POTW problem is linked to a particular pollutant discharged (e.g., collection system blockages caused by the discharge of excess oils and grease from food establishments). POTWs have authority to enforce their SUO or rules or regulations against non-SIUs without the need for any type of individual control mechanism. Control Authorities have the authority to require non-SIUs to comply with pretreatment standards and requirements contained in their local regulations and then take appropriate actions against IUs as noncompliance is identified.

Inspections
Control Authorities are required to inspect and sample all SIUs a minimum of once per year pursuant to 40 CFR §403.8(f)(2(v). The frequency with which a Control Authority actually inspects an SIU may vary depending on issues such as the variability of an SIU's effluent, the impact of their discharge on the POTW, and their compliance history. Inspection considerations will hinge upon the type of inspection performed (i.e., scheduled, unscheduled or demand).

The EPA's 2017 *Industrial User Inspection and Sampling Manual for POTWs* provides a detailed reference for inspection procedures and protocols. Scheduled inspections are useful when the Control Authority wants to gather specific information from the facility that necessitates meeting with specific SIU contacts.

However, since scheduled inspections may interrupt normal operations (e.g., altered production schedule as a result of preparative work undertaken by the IU), unscheduled inspections may more accurately reflect IU compliance status when the inspection is performed for that reason.

POTWs must evaluate, at least once every two years, whether each SIU needs a plan to control slug discharges (i.e., a discharge of a non-routine, episodic nature, including but not limited to an accidental spill or non-customary batch discharge). To accurately evaluate the slug potential, Control Authorities likely will have to examine the SIU during normal operating conditions. If undetected, slug discharges can have serious impacts on the POTW.

The EPA's 1991 *Control of Slug Loadings to POTWs Guidance Manual* provides a description of procedures for development, implementation, and review of slug control plans. Demand inspections are non-routine in nature and occur in response to a concern (e.g., POTW collection problems downstream from an IU, elevated enforcement actions against an IU, suspicious IU behavior, or an informer complaint).

Routine Control Authority inspections of SIUs typically consist of three activities; preparation, on-site assessment, and follow-up.

Preparation *(Credit USEPA)*
Control Authority personnel should review POTW records for SIUs to be inspected to familiarize themselves with the facility. Information reviewed may include compliance status, compliance schedule activities, reports and plans, upcoming report and plan due dates, enforcement activities, permit applications, waste surveys, previous inspection summaries, categorical regulations, water use/billing records, and POTW collection system maps.

Control Authority personnel should also be familiar with any specific issues and concerns regarding the POTW treatment plant or collection system problems receiving the SIU's discharge.

On-site Assessment
Control Authority personnel typically discuss IU operations with IU contacts and perform a walkthrough of the facility to: update IU information regarding contacts, processes, production rates, pretreatment, and other waste management activities; review records required to be kept by the IU; visually verify the need for a slug control plan; and review pretreatment system maintenance, categorical standards applicable to processes employed, metering and sampling equipment, sampling procedures, chemicals used, processes employed, management practices, containment structures, locations of floor drains, etc. Many POTWs have developed a standard inspection questionnaire to facilitate the interview process and promote consistency during the inspection.

Follow-up
An inspection report should be prepared as soon as possible after the inspector returns to the office. Unanswered questions, required permit modifications, and/or necessary enforcement actions should be processed in a timely manner. Non-routine inspections (e.g., demand) may not encompass all the activities and steps specified above, but, like routine inspections, these activities may provide the Control Authority an opportunity to collect samples of the IU’s discharge.

3.3 When to Issue a Permit

Once all potential permittees have been identified, the permits should be issued as soon as possible. If the Control Authority will be permitting several SIUs, it might be helpful to issue the permits with staggered expiration dates to balance the permit reissuance workload in the future. Control Authorities should plan to reissue permits before they expire.

Many Control Authorities require existing SIUs to apply for initial permits within 6 months of the adoption of local ordinance provisions authorizing a permit program. New SIUs permits must be issued before SIUs begin discharging to the sewer system. Control Authorities have typically required each SIU to submit an application for permit reissuance at least 90 days before the expiration date of the applicable existing permit to provide the Control Authority with sufficient time to adequately evaluate the discharge, develop permit conditions, and issue the permit on or before expiration.

The Control Authority's most important task is to have all SIUs under enforceable control mechanisms that contain specific discharge conditions that are based on all available information at the time of permit issuance. In instances where a Control Authority has a large number of SIUs, the initial permit issuance, including thorough site inspections, could create a considerable backlog of Industrial Users waiting to be permitted.

The Control Authority might want to issue short-term permits or full-term permits with reopener conditions allowing permit modification when more complete information has been obtained. In addition, the Control Authority might want to determine whether to implement general control mechanisms for similar nondomestic dischargers that have similar processes and wastewater characteristics (for further details on general control mechanisms. However, such control mechanisms must still contain the minimum elements required by the Pretreatment Regulations (outlined in Topic 5) and should be based on all existing data available to the permit writer at that time.

3.4 What Types of Permits to Use

Keeping in mind that the purpose of issuing permits is for the Control Authority to notify Industrial Users of the specific standards and requirements that they must meet, the Control Authority could choose to develop and issue different types of permits for different reasons. The choice might result in improved communication of requirements to the permittee or could result in a resource savings for the Control Authority. Whether the Control Authority chooses to issue individual, facility-specific permits or general control mechanisms to multiple facilities, a control mechanism issued to SIUs must still contain the minimum elements required by the Pretreatment Regulations.

3.4.1 Individual Control Mechanisms

The most traditional type of control mechanism is the individual, facility-specific permit. Although this permit might contain general and specific prohibitions, categorical standards, and local limits that are very similar or the same as those issued to other facilities in the Control Authority service area, the bases of the standards and requirements are individually considered and determined. These types of permits are appropriate when the Control Authority might have special circumstances that are unique to a single facility. For example, individual control mechanisms (and not general control mechanisms) will be necessary when issuing permits for discharges where the Categorical Pretreatment Standards are production-based and where the Categorical Pretreatment Standards are expressed as mass of pollutant discharged per day because the Categorical Pretreatment Standards is not expressed as a single number but must be calculated for the specific user.

Similarly, an individual control mechanism will be necessary in other circumstances requiring adjustments or calculation to determine the allowable discharge under the pretreatment standard, e.g., where wastestreams subject to categorical standards are combined with other wastestreams before a sampling point or where net/gross allowance is granted.

General Control Mechanisms
In addition to individual Industrial User permits, the Control Authority may have the option to issue general control mechanisms to its Industrial Users. Provided that the approved POTW's pretreatment program includes the general control mechanism provisions in accordance with 40 CFR Part 403 and the state regulations allow for this provision, the Control Authority may use a general control mechanism for facilities that meet the following minimum criteria for being considered substantially similar:

- Involve the same or substantially similar types of operations
- Discharge the same types of wastes
- Be subject to the same effluent limitations
- Be subject to the same or similar monitoring
- In the opinion of the POTW, be more appropriately controlled under a general control mechanism than under individual control mechanisms

Using general control mechanisms allows the Control Authority to allocate resources more efficiently and to provide timelier permit coverage. General control mechanisms would be an available tool for permitting similar SIUs that are subject to concentration-based standards or BMPs (or both). However, general control mechanisms are not available for SIUs regulated by categorical Pretreatment Standards expressed as mass limits, which are inherently unique to each user.

The one exception to such a situation is where the POTW has imposed the same mass-based local limit and any categorical Pretreatment Standards that are expressed as concentration limits or BMPs on a number of facilities. In addition, general control mechanisms are not available for Industrial Users whose limits are based on the Combined Wastestream Formula (CWF) or Net/Gross calculations, or other calculated categorical Pretreatment Standard equivalents [40 CFR 403.6(e) and 40 CFR 403.15].

Before issuing general control mechanisms, the Control Authority should consider how it will notify SIUs, subsequent to their filing a written request of coverage, that they are authorized to discharge under the general control mechanism. In addition, the Control Authority should consider how it will memorialize certain facility-specific factors such as sampling locations and any monitoring waivers (e.g., pollutants not present). In situations where a CIU has requested both coverage under a general control mechanism and a monitoring waiver, it is the Control Authority's decision whether to exclude the CIU with sampling waivers from coverage under a general control mechanism.

If the Control Authority believes that a general control mechanism is still appropriate for a CIU with monitoring waivers to be covered under a general control mechanism, the Control Authority should determine what mechanism it will use to incorporate facility-specific monitoring waivers into a general control mechanism.

Some possible mechanisms for addressing facility-specific monitoring waivers include issuing a separate monitoring supplement to the general control mechanisms for the individual CIUs, using the waiver approval notice as a facility-specific modification to the general control mechanism, or appending the general control mechanism with specific monitoring waivers [70 FR 60147; October 14, 2005].

3.5 Permit Durations

An Industrial User permit must not be issued for an indefinite term. The regulations at 40 CFR 403.8(f)(1)(iii) require both individual and general control mechanisms to be limited to a maximum 5year period; however, local or state law may mandate a shorter maximum duration. A short-term permit is recommended where the permit writer knows that the Industrial User is planning a major process change or the business has been advertised for sale. Moreover, a short-term permit is also advisable where the permit writer is aware of proposed changes in the federal, state, or local pretreatment program that might significantly affect how the user will be regulated in the future (e.g., a revision to include a categorical Pretreatment Standard). The permit writer should insert a condition to allow the Control Authority to reopen the permit when changes occur or, if authorized to do so, may simply choose to modify the permit under its general modification authority (see Section 3.6 below).

3.6 When to Modify or Terminate Permits

3.6.1 Permit Modifications

Control Authorities must be able to revise their individual permits or general control mechanisms to implement revisions in federal, state, and local program requirements and make mid-course corrections or adjustments to reflect significant changes in the user's circumstances. At a minimum, the Control Authority's ordinance should always provide (and the permit should indicate) the authority for the Control Authority to modify the permit when there is good cause to do so. The ordinance may also detail the circumstances that represent good cause for modification.

Generally speaking, permits should not be modified to make discharge standards less stringent where the user is in compliance with the current permit conditions and no changes in operations justifying a relaxation of the permit are involved. Common justifications for modifying permits include the following:

- Alterations in the Industrial User's operations, including production rates, that result in new pollutant contributions or substantial changes (increases or decreases) in the amount of pollutants discharged or the volume of wastewaters discharged
- New information that was not available at the time the permit was issued
- New federal, state, or local requirements promulgated since the time of permit issuance (e.g., revised categorical standards or local limits)
- Correcting technical mistakes, erroneous interpretations of federal, state or local law, or typographical errors

To the extent that the Control Authority allows Industrial Users or interested members of the public to request permit modifications, it is recommended that such requests be made in writing and include facts or reasons that support the request. If the Control Authority is required to, or routinely provides, public notice of draft permits, any proposal for a significant modification should also be subjected to similar public scrutiny. Public participation in the permit issuance process is discussed further in Section 3.8 of this manual. To avoid nonproductive paperwork, the Control Authority might wish to structure its procedures so that minor modifications to the permit need not be subject to the public notice procedure.

The following typically qualify as minor changes:

- Correcting typographical errors
- Imposing more frequent monitoring or reporting conditions
- Changing interim compliance dates in compliance schedules (which will *not* affect the final compliance date)

Generally, a permit can be modified in a number of ways. One method, where extensive modifications are necessary, is to reissue an entire new permit with the modifications incorporated. Another method, if only one section of the permit needs modification, could be to issue an addendum to the existing permit. Addendums issued separately from the permit could be overlooked or misplaced, so the Industrial User should be instructed to replace the original section of the permit that is being modified with the addendum or attach the addendum to the permit. The POTW should clearly document the modification and include the modified permit section in the administrative file.

When modifying a permit, the permit writer should allow a reasonable time frame for the Industrial User to comply with the new or changed conditions if the user cannot meet them at the time of the modification and if allowed by law. If such new or changed conditions are the result of new or changed categorical pretreatment regulations, the regulations will stipulate the compliance period.

The Control Authority cannot extend the federal compliance period. Of course, if the Industrial User is already complying with the modified condition, no compliance or *grace period* should be provided. The compliance period must be clearly designated in the modified permit. In no event, however, may a compliance schedule relieve the user of its duty to comply with currently applicable Pretreatment Standards and Requirements.

3.6.2 Permit or Discharge Terminations or Suspensions

Situations could arise during the effective period of a permit that require the Control Authority to suspend or terminate the Industrial User's authorization to discharge into the sewer system. The General Pretreatment Regulations require, as a condition for an approved pretreatment program, that the Control Authority has the authority to terminate the Industrial User's discharge if it presents or might present an endangerment to the environment or if it threatens to interfere with the operation of the treatment works [see 40 CFR 403.8(f)(l)(vi)(B)]. Use of permit suspensions or terminations should be included in the Control Authority's enforcement response plan. Development of such a strategy is described in EPA's *Guidance for Developing Control Authority Enforcement Response Plans*.

3.7 Permit Transferability

The Control Authority must be given prior notification of owner/operator transfers and be given the opportunity to question the new owner/operator regarding plans to redesign or otherwise change the process or management practices at the facility. The Control Authority should, therefore, require advance written notice of all proposed owner/operator transfers, preferably at least 30 days in advance of the transfer. In addition, if the Control Authority does not wish to provide for transfers for changes in owner/operator, it may simply revoke the existing permit and reissue a new permit to the new owner/operator. The Control Authority must clearly specify permit non-transferability requirements in the Industrial User permit.

3.9 Issuing the Final Permit

After the public participation requirements, if any, are satisfied, the Control Authority revises the draft permit as necessary and proceeds to issue the final permit to the Industrial User. A transmittal letter accompanying the permit should summarize its contents. For example, the cover letter should contain the permit's effective and expiration dates, its enforceability, and any applicable procedures for appealing the permit conditions. To ensure that the Industrial User receives the permit, it is recommended that one of the following delivery methods be followed: hand delivery or sending the permit by certified mail with return receipt requested.

Legal Authority for a Permit Program

The legal authority of a POTW or other local Control Authority to administer a permit program is derived from state law and local ordinance. Although this Topic describes the legal authority and procedures required for a POTW to implement an effective permit program, a state acting as the Control Authority must have similar legal authorities and procedures in place.

State law will determine what authorities are available to the Control Authority and, thus, the Control Authority must be aware of the laws when developing or seeking modifications to its local legal authority. The local legal authority (which constitutes the Control Authority's exercise of the authority conferred by state law) must describe the permit program in sufficient detail so that Industrial Users and permit writers will know the procedures, expectations, and liabilities associated with the program.

The Control Authority should request its attorney to assist in reviewing the legal authority to ensure that it provides adequate authority and that the legal authority does not create any unnecessary procedural or institutional obstacles that might hinder the permit program. If the legal authority must be modified to establish a permit program, the Control Authority should bear in mind that such modifications are considered a substantial modification requiring approval by the Approval Authority (EPA or state) in accordance with the procedure at 40 CFR 403.18.

Signature
In all cases, a signature should be obtained from the person accepting delivery of the permit. This signature should indicate only that the applicant has received the permit. There should *not* be a statement indicating that, by signing, the permittee agrees to comply with the terms and conditions of the permit.

Such a statement could, depending on the circumstances, be misconstrued as changing the legal nature of the document from a permit to a contractual agreement; thereby affecting the interpretations and enforceability of the terms and conditions of the permit.

The use of contracts or contractual agreements as a control mechanism does not provide a POTW with the requisite penalty authority for an approved program and are not an adequate control mechanism for POTWs with an approved program. A control mechanism signed by the permittee may be deemed a contract and thus lose its effectiveness as a control mechanism [53 FR 40574-40577; October 17, 1988].

Although each Control Authority will have its own set of procedures, the basic procedure for permit issuance will usually be the same.

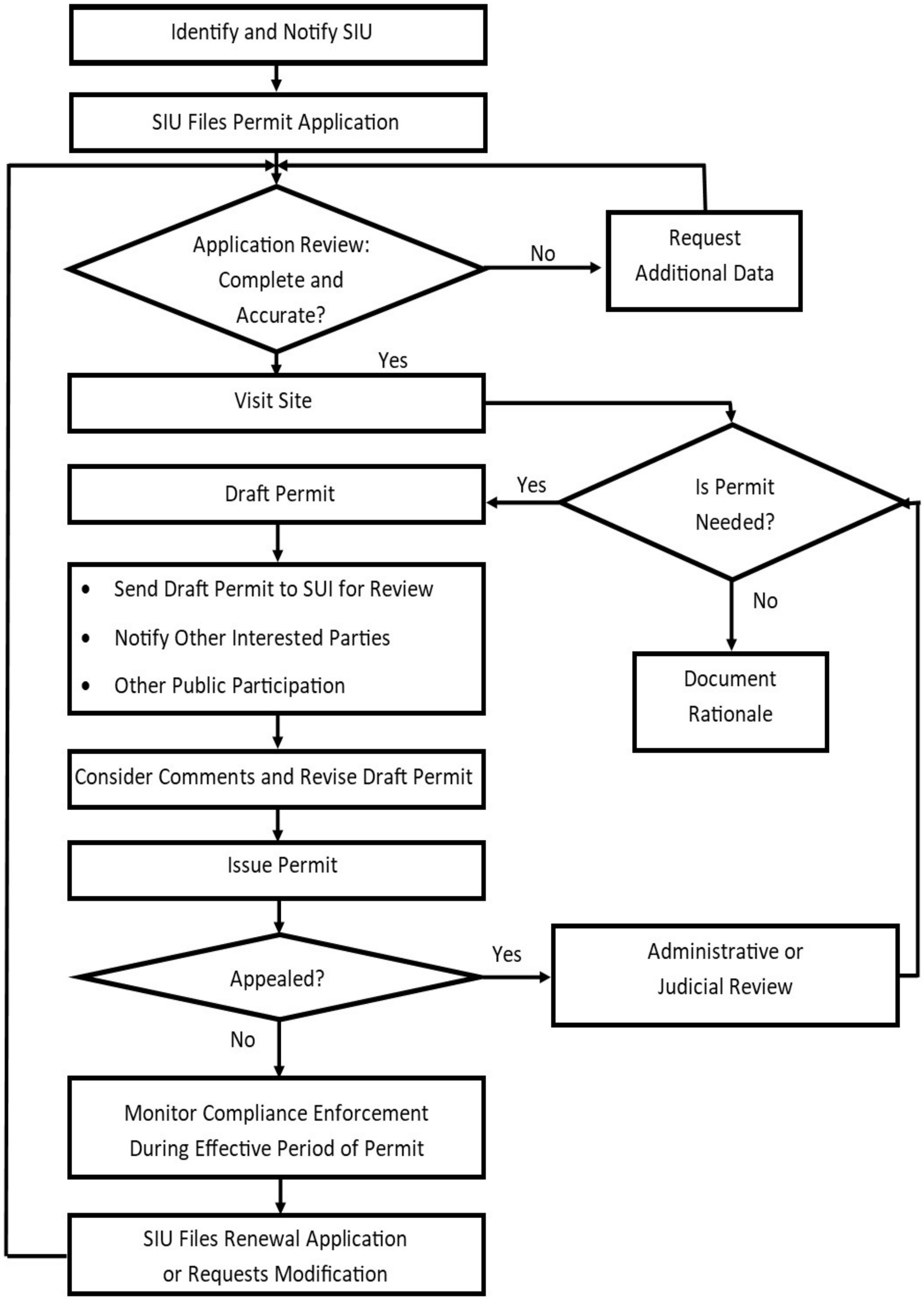


FIGURE 3-1. COMMON ELEMENTS OF AN INDIVIDUAL PERMIT ISSUANCE PROCESS

3.10 Legal Authority

Under general principles of administrative law, permit applicants and other interested parties typically may challenge the Control Authority's permit decisions. Such challenges may include issues related to the authority of the Control Authority for conditioning and issuing the permit. Therefore, the Control Authority must ensure that it has the requisite legal authority to impose Pretreatment Standards and Requirements in Industrial User permits and control mechanisms and that it exercises its authority in a nonarbitrary manner.

Assuming that state law authorizes Control Authorities to issue and enforce permits, the local ordinance must clearly provide the Control Authority with the following authorities [40 CFR 403.8(f)(1)(iii)]:

- Authority to regulate all Industrial Users contributing wastewater to the POTW
- Authority to require and issue Industrial User permits, orders, or other control mechanisms, including
    - Authority to require Industrial Users to submit all data that the Control Authority deems relevant to permit decisions and provisions for public access to data
    - Authority to enter, inspect, and sample to verify information supplied by the Industrial User as well as to assess the Industrial User's compliance status
    - Authority to incorporate local limits, including BMPs (if applicable)
    - Authority to incorporate federal and state Pretreatment Standards and Requirements
    - Authority to require self-monitoring, record keeping, and reporting by permittee
    - Authority to develop other appropriate permit conditions
- Authority to enforce sewer use ordinance and discharge permit violations
- Authority to require the development of a slug discharge control plan

Each of these authorities is discussed briefly below. EPA's *Model Sewer Use Ordinance* contains sample sewer use ordinance provisions addressing permit issuance and enforcement.

3.11 Authority over All Industrial Users Contributing to the POTW
A Control Authority must be able to impose and enforce applicable Pretreatment Standards and Requirements on every nondomestic user contributing wastewater to its collection system. Therefore, it is necessary that the Control Authority's sewer use ordinance provides it with the requisite authority to issue control mechanisms, conduct compliance monitoring activities, and, when warranted, take appropriate enforcement action in response to noncompliance by Industrial Users within its boundaries.

However, many Control Authorities serve Industrial Users beyond their political boundaries (e.g., beyond a city's limits or county line) and the legal authority to implement the Pretreatment Program in these *multijurisdictional* areas might be uncertain.

Such circumstances typically require the Control Authority to take additional measures to ensure its regulatory authority throughout its service area. Control Authorities should consult their attorneys for approaches under state and local laws to any multijurisdictional problems. For additional information regarding multijurisdictional agreements, refer to the *Multijurisdictional Pretreatment Programs Guidance Manual*.

3.12 Authority to Require and Issue Individual Permits and General Control Mechanisms

3.12.1 Requiring Industrial Users to Obtain Permits

The legal authority for a permit system, whether in a local sewer ordinance or state law, must make it clear that Industrial Users covered by the permit program must obtain a permit or be subject to control under some general control mechanism. The permit should be obtained as a precondition to discharging wastewater into the sewer system. This requirement places the burden on the Industrial User to come forward and identify itself or risk an enforcement action for failing to obtain a permit. In addition, if the POTW plans to use general control mechanisms, the SIU requesting coverage under a general control mechanism must file a written request for coverage. EPA recommends that Control Authorities develop a permit boilerplate that includes all the requirements listed at 40 CFR 403.8(f)(2)(iii)(B).

Most Control Authority permit issuance does not involve public comment or public notice. EPA recommends that the Control Authority provide a draft permits to the Industrial User before issuance for review. When public comment or notice is required, the POTW may provide public notice of the draft permit or hold a public hearing.

3.12.2 Submitting Data

The legal authority should authorize the Control Authority to require the Industrial User to submit information on its facility, processes, raw materials, flows, pollutant discharge, storage areas, production, and other environmental permits held. Typically, because each Industrial User is unique, the Control Authority should also be able to require that the user submit additional information as might be necessary to evaluate its wastewater discharge and spill potential. CIUs, are however, required to submit baseline monitoring reports (BMRs) [40 CFR 403.12(b)]. Some POTWs use the BMRs from CIUs as applications. The legal authority must ensure that information submitted to the Control Authority that meets EPA's definition of *effluent data* under 40 CFR 2.302 will be available to the public without restriction [40 CFR 403.14].

In addition to collecting the necessary data through an application, the Control Authority could also obtain this data through a site visit to the facility in question.

If an SIU is requesting coverage under a general control mechanism, the Control Authority must ensure that the Industrial User identifies its contact information, production processes, the types of waste generated, and the monitoring location or locations at which all regulated wastewaters will be monitored.

The request for coverage should also include a finding that the SIU properly falls within the category of facilities covered by the general control mechanism.

In addition, the user's request for coverage should include an indication of whether the user is requesting a monitoring waiver for pollutants not present. SIUs that are requesting monitoring waivers for pollutants neither present nor expected to be present might still quality for coverage under a general control mechanism. Control Authorities will need to determine whether such facilities could still meet the required criteria for being considered substantially similar. EPA specifies that the monitoring waiver is effective in the general control mechanism only after the SIU obtains written approval from the POTW that the monitoring waiver request has been approved.

3.12.3 Entering and Inspecting

EPA regulations require the Control Authority to have the authority to enter and inspect Industrial Users' facilities. This authority must be at least as extensive as EPA's own broad authority under section 308 of the CWA. At a *minimum*, such entry and inspection authorities must allow the Control Authority's authorized representative(s) to, (1) have a right of entry to, upon, or through any premises in which an effluent source is located or in which records required to be maintained by the permittee are located, and (2) have access to and copy any records, inspect any monitoring equipment or methods (required of the permittee), and sample any effluent that the owner or operator of the source is generating [40 CFR 403.8(f)(l)(v)].

3.12.4 Imposing Local Limits (including BMPs)

The Control Authority is obligated to develop and enforce local limits or BMPs necessary to implement and enforce the general and specific prohibitions [40 CFR 403.5]. The legal authority must state that such local limits or BMPs or both may be imposed on Industrial Users directly through the legal authority, through Industrial User permits, and through additional control mechanisms that the Control Authority intends to use as part of its pretreatment program.

3.12.5 Imposing Federal and State Requirements

Control Authorities are responsible for enforcing federal and state Pretreatment Standards and Requirements as well as local limits. The legal authority must specifically require compliance with the general and specific prohibitions [40 CFR 403.5] and any other requirements mandated under state law. The Control Authority must have the authority to enforce all these requirements and to impose and enforce them through Industrial User permits [40 CFR 403.8(f)(1)(ii)]. Moreover, the Control Authority must ensure that the legal authority does not provide for any variance or adjustment of the requirements other than those authorized under applicable state or federal law.

3.12.6 Requiring Industrial Users to Self-Monitor, Keep Records, and Report

Federal regulations require certain classifications of Industrial Users to conduct periodic self-monitoring, maintain sampling records, routinely report on their compliance status, and disclose any changing conditions or planned alterations at their facilities [40 CFR 403.12]. The Control Authority must have the legal authority to impose and enforce such requirements in Industrial User permits. In addition, the ordinance should authorize the Control Authority to impose and enforce those or similar obligations on other Industrial Users. Furthermore, for any user determined by the Control Authority to be an NSCIU, the Control Authority must require an annual certification requirement in accordance with 40 CFR 403.12(q).

3.12.7 Imposing Other Conditions based on State or Local Requirements

In many instances, the Control Authority will have developed other local requirements or conditions applicable to Industrial User discharges. These conditions are in addition to those required by the National Pretreatment Program.

These conditions might include such things as user fees, a cross-connection prohibition, backflow prevention fees, or surcharge fees for excessive Industrial User loading of compatible pollutants above surcharge threshold values (i.e., Biochemical Oxygen Demand (BOD), Total Suspended Solids (TSS), ammonia, oil and grease). Surcharge threshold values are not considered maximum ceiling concentration effluent limits. If a discharger exceeds a surcharge threshold value, the discharger is not in violation of an effluent limit.

Surcharge fees are typically established on the basis of the POTWs' cost for treating the excessive compatible pollutant loadings. Therefore, the Control Authority should ensure that any surcharge threshold values are clearly specified as such and are not characterized as enforceable maximum discharge limits.

Because surcharge threshold values are not the same as effluent limits, the permit writer should not include surcharge threshold values in the same table or section as effluent limits.

Although such conditions might not directly relate to controlling interference or pass through, they are nonetheless Industrial User requirements and may be included as permit conditions. For this reason, the Control Authority must have the legal authority to impose such conditions in Industrial User permits as the Control Authority deems necessary or desirable. In addition, the permit and its fact sheet should clearly state the authority by which the condition is being imposed.

3.13 Authority to Enforce Permit Violations

Few legal authorities explicitly mandate all the specific pretreatment requirements that a Control Authority may be authorized to impose through a permit on an Industrial User. In other words, they leave many details regarding the contents and issuance of a permit to the discretion of the Control Authority, in general, and the permit writer in particular.

While it isn't necessary for the legal authority to describe in detail the specific requirements for each Industrial User, the individual permit will contain the applicable, typically more detailed and enforceable requirements applicable to the specific individual Industrial User. The legal authority should specify the enforcement response alternatives available to the Control Authority including injunctive relief, civil and criminal penalties, and service termination.

3.2 Sewer System Evaluation *(Credit USEPA)*

On a regular basis, selected locations in the sewer system are sampled to develop background data for purposes of updating the local limits, and to screen areas for higher than "background" pollutant levels. In addition, problem areas are sampled on an as needed basis to determine potential sources of Code violations that either occur on a frequent basis, or are the result of a slug load to the sewer system.

To monitor sewers for background information, the sampling program would typically be conducted over a four-day period. In instances where the intent is to determine sources of pollutants and/or slug loads, the length of the program would vary.

Compliance Monitoring

There are two types of sampling activities that are performed as part of compliance monitoring for permitted industries: unscheduled and demand.

Unscheduled sampling is used to determine the compliance status of the user. Instances of noncompliance are often identified during unannounced monitoring visits. No notice is given for this type of sampling. This type of sampling is performed two to four times a year, at each industrial user site, over a two to five-day period to obtain sampling data

Demand sampling is usually initiated in response to a known or suspected violation, discovered as a result of a self-monitoring report, routine sampling visit, public complaint, unusual influent condition at the wastewater treatment plant, or emergency situations (e.g., plant upsets, sewer line blockages, fires, explosions, etc.). Most often, this type of sampling is conducted to support enforcement actions against an industrial user. This type of sampling activity is performed on an as needed basis.

The length of the sampling program depends on the flow, nature of the wastes, and type of samples (i.e., grab or composite) to be collected.

Typically, composite and grab samples are collected at each user site.

Nonpermitted Industrial Users (User Rate Charge Program) (Example Policy)

On a periodic basis (i.e., once every two to three years), commercial and minor industrial users are sampled to determine discharge concentrations of various pollutants. Typical types of users which may be sampled include: restaurants, photo processing laboratories, laundries, car washes, and printing shops.

A three- to four-day sampling program is usually conducted at each assigned site. Commercial establishments are sampled to establish BOD and SS levels for various groups of users for the Finance/ Utilities department.

This activity is also helpful in identifying industrial or commercial users which may discharge pollutants of concern.

Topic 3- Identifying Industrial Users Post Quiz

Legal Authority

1. The General Pretreatment Regulations do not provide _______________with the legal authority to carry out their pretreatment programs; rather, the regulations set forth the minimum requirements for POTWs with pretreatment programs.

2. A Control Authority may enter into a contract with________________, although contracts generally limit the enforcement capabilities of the Control Authority. As such, contracts should only be pursued when all other means fail.

3. Control Authorities must ensure that the entire service area is reviewed. This may include IUs located outside the jurisdictional boundaries of the _________________.

Inspections

4. What is the term used that are required to inspect and sample all SIUs a minimum of once per year pursuant to 40 CFR §403.8(f)(2(v)?

5. Routine Control Authority inspections of _______________ typically consist of three activities; preparation, on-site assessment, and follow-up.

Preparation

6. Control Authority personnel should also be familiar with any specific issues and concerns regarding the POTW treatment plant or collection system problems receiving the _____________.

When to Issue a Permit

7. Once all ____________________ have been identified, the permits should be issued as soon as possible.

What Types of Permits to Use

8. Keeping in mind that the purpose of ___________________is for the Control Authority to notify Industrial Users of the specific standards and requirements that they must meet, the Control Authority could choose to develop and issue different types of permits for different reasons.

General Control Mechanisms

9. Using general control mechanisms allows the Control Authority to allocate resources more efficiently and to provide timelier permit coverage. _______________________ would be an available tool for permitting similar SIUs that are subject to concentration-based standards or BMPs (or both).

Permit Transferability

10. What is the term used that must be given prior notification of owner/operator transfers and be given the opportunity to question the new owner/operator regarding plans to redesign or otherwise change the process or management practices at the facility?

Legal Authority for a Permit Program

11. The Control Authority should request its attorney to assist in reviewing the legal authority to ensure that it provides adequate authority and that the legal authority does not create any unnecessary procedural or institutional obstacles that might hinder the_______________.

Signature

12. The use of contracts or contractual agreements as a control mechanism does not provide a _______________ with the requisite penalty authority for an approved program and are not an adequate control mechanism for POTWs with an approved program.

Legal Authority

13. Under general principles of administrative law, ______________________and other interested parties typically may challenge the Control Authority's permit decisions.

Authority over All Industrial Users Contributing to the POTW

14. Many Control Authorities serve ___________________ beyond their political boundaries (e.g., beyond a city's limits or county line) and the legal authority to implement the Pretreatment Program in these *multijurisdictional* areas might be uncertain.

Requiring Industrial Users to Obtain Permits

15. EPA recommends that the ___________________________ provide a draft permits to the Industrial User before issuance for review.

Submitting Data

16. The request for coverage should also include a finding that the _________________ properly falls within the category of facilities covered by the general control mechanism.

Entering and Inspecting

17. At a *minimum*, such entry and inspection authorities must allow the Control Authority's authorized representative(s) to, (1) have a right of entry to, upon, or through any premises in which an effluent source is located or in which records required to be maintained by the _________________are located, and (2) have access to and copy any records, inspect any monitoring equipment or methods (required of the permittee), and sample any effluent that the owner or operator of the source is generating [40 CFR 403.8(f)(l)(v)].

Imposing Local Limits (including BMPs)

18. The legal authority must state that such local limits or BMPs or both may be imposed on Industrial Users directly through the legal authority, through Industrial User permits, and through additional control mechanisms that the ______________________ intends to use as part of its pretreatment program.

Imposing Federal and State Requirements

19. What is the proper term used for responsible for enforcing federal and state Pretreatment Standards and Requirements as well as local limits? The legal authority must specifically require compliance with the general and specific prohibitions [40 CFR 403.5] and any other requirements mandated under state law.

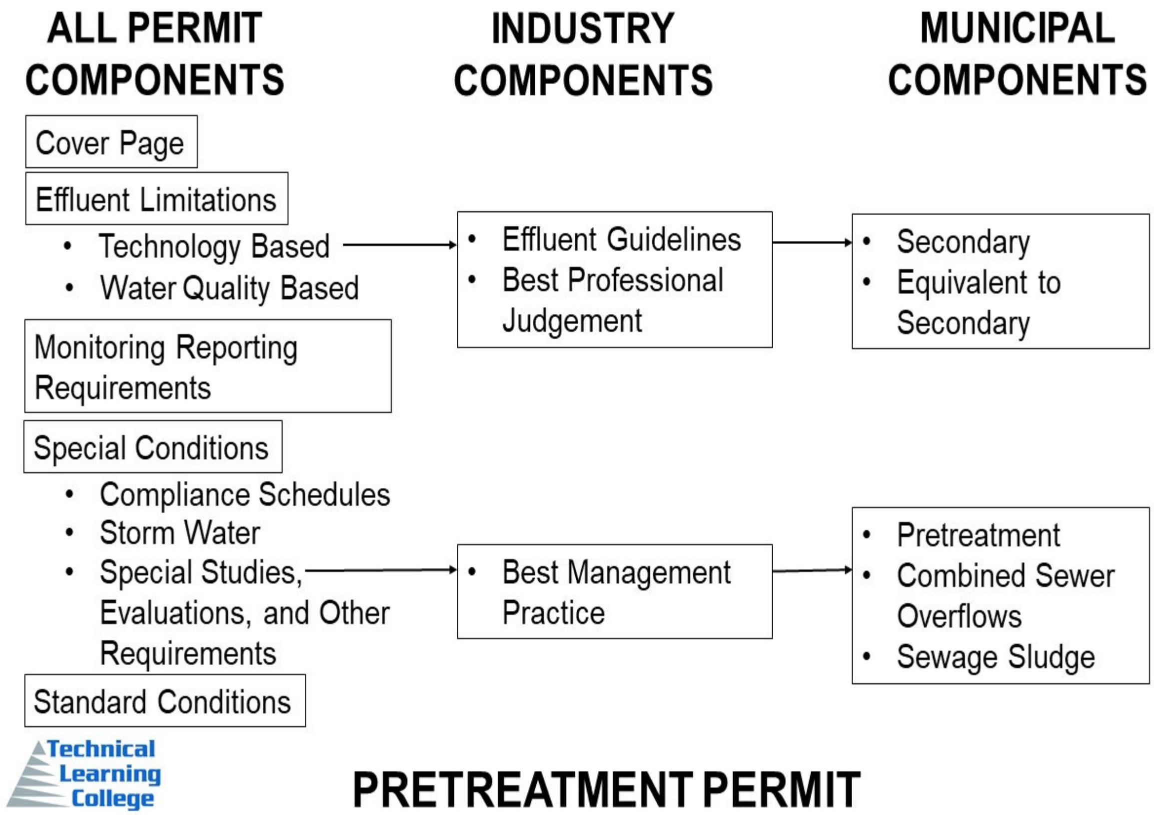
Imposing Other Conditions based on State or Local Requirements

20. In many instances, the ____________________ will have developed other local requirements or conditions applicable to Industrial User discharges. These conditions are in addition to those required by the National Pretreatment Program.

Topic 4 - Permit Applications Section

Topic 4 - Section Focus: You will learn the basics of industrial/commercial POTW permitting. At the end of this section, you will be able to understand and describe Clean Water Act's rule concerning pretreatment permitting of various industrial users and the importance of proper documentation. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 4 – Scope/Background: The Industrial Pretreatment program requires the permit writer to properly evaluate and verify the completeness and accuracy of the reporting/permitting/sampling data because it is used as a basis for permitting decisions.



After the Control Authority has established its permitting procedures and legal authority (as discussed in Topics 2 and 3), permit preparation can begin in earnest.

The initial step in this process is to obtain and review Industrial User data from the permit application and all other pertinent background information. The permit writer must evaluate and verify the completeness and accuracy of the data because they are used as a basis for permitting decisions.

4.1 What Information to Collect and How to Collect it

A permit application enables the Control Authority to obtain the information necessary to evaluate the quality and quantity of wastewater to be discharged and to determine what controls are necessary for the Control Authority to accept the wastewater. The Control Authority should have the legal authority to require an Industrial User to complete and file a permit application to receive a permit. In addition, Control Authority should consider requiring an existing permittee to submit an application with updated information for a reissued permit. The permit application serves as the formal request from the Industrial User to the Control Authority to connect or discharge to the sewer system.

The permit application format should be standardized so that all necessary information is requested but should also allow the applicant the leeway to include narrative information. The Industrial User should be required to provide manufacturing process flow and wastewater characteristics, and information regarding any existing BMPs.

Other information, such as number of employees, list of chemicals used or stored, and plumbing schematics, is also vital to the permit writer. The number of employees can indicate the estimated volume of sanitary flow, and the list of chemicals used by the facility can indicate potential pollutants present in the wastestream. This information can lead to a better understanding of the facility's operations, which, in turn, enables the permit writer to evaluate the Industrial User's discharge comprehensively and to develop adequate and appropriate permit conditions. An example of an application form is in Appendix C.

If the Control Authority does not require an Industrial User to complete a permit application to receive a permit, the Control Authority could compile the necessary information to draft a permit by reviewing the Industrial User's BMR (if the user is a CIU), reviewing historical effluent data, or conducting a site inspection of the user's facility.

Application Review Process
After receiving the completed application, the review process begins. First, the Control Authority should review the application for completeness and accuracy. Because the draft permit is based on the information in the application, it is imperative that the permit writer use all means possible, including inspecting the facility (for more information regarding facility inspections, see Section 4.2.4), to verify the completeness and accuracy of the application.

4.2.1 Completeness
At a minimum, the application form should have all applicable spaces filled in and should be signed and dated by the authorized Industrial User representative with the appropriate signatory certification. Instructions provided to the Industrial User on how to complete the application should state that all items must be completed and that the term *not applicable* should be used to show that the item was considered but was not pertinent to the facility.

If blanks do appear on the submitted application form, the permit writer should obtain a response to the items before issuing a permit. In some cases, obtaining a response can be handled over the telephone, with the phone conversation documented in writing.

However, the permit writer may choose to meet the responsible party at the facility to explain and assist in completing the missing application information and to clarify questions that might not have been understood. The most reliable method is to obtain the response in writing by returning a copy of the application to the applicant for completion.

Such a method has the advantage of requiring the permit applicant to actually fill in the blanks in a copy of the originally submitted application, thereby allowing greater clarity as to who provided the information and who is responsible for any inaccuracies or distortions of fact. The Industrial User should be required to initial and date any changes.

The Control Authority should also have the Industrial User resubmit the revised application with a new signatory certification.

Additionally, the permit writer should conduct a facility inspection to determine whether the information on the application is complete. If changes or corrections to any application are extensive, the Control Authority should exercise its information gathering authority to request a revised, complete application instead of an incomplete application that is later augmented with multiple attachments.

When reviewing the application for completeness, the permit writer should make sure that three items—which are often overlooked by applicants—are included in the application: (1) the facility's sewer piping layout and process diagrams; (2) effluent data (new facilities would not have effluent data but could provide effluent data from another facility using the same production process, chemicals, and treatment process), and (3) a list of raw materials used at the facility.

In some cases, such as where significant dilution is thought to occur, data on the characteristics of internal wastestreams, particularly treatment unit effluents, might be needed to assess the adequacy of existing pollution controls and the feasibility of achieving greater reductions of pollutants in the effluent. In addition, data on flows of internal wastestreams must be known if the permit writer is applying the CWF [40 CFR 403.6(e)].

Pollutant data on the final effluent might not always be adequate for complex facilities where internal wastestreams can be diluted by large volumes of cooling water before the sampling point. Waste characterization (through sampling and analysis) of individual wastestreams might be necessary. Where an Industrial User discloses that a pollutant is present in the effluent, the permit writer should include a monitoring requirement for that pollutant. A review of all raw materials will allow the permit writer to decide what pollutants warrant limits or monitoring requirements or both. The permit writer should not hesitate to require any supplementary information (such as more detailed production information or monitoring data) needed to develop the permit.

Finally, the application should be signed by a responsible corporate officer of the Industrial User because submitting false information is subject to significant penalties under federal law. EPA regulations [40 CFR 403.12(l)] require that reports from CIUs be signed by one of the following persons:
a) By a responsible corporate officer, if the Industrial User submitting the reports, required by 40 CFR 403.12(b), (d), and (e), is a corporation. For the purposes of this paragraph, a responsible corporate officer means

(i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principle business function, or any other person who performs similar policy- or decision-making functions for the corporation, or

(ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions that govern the operation of the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiate and direct other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; can ensure that the necessary systems are established or actions taken to gather complete and accurate information for control mechanism requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

b) By a general partner or proprietor if the Industrial User submitting the reports, required by 40 CFR 403.12(b), (d), and (e), is a partnership or sole proprietorship, respectively.
c) By a duly authorized representative of the individual designated in 40 CFR 403.12(l)(1) or 403.12(l)(2) if (i) The authorization is made in writing by the individual described in 40 CFR 403.12(l)(1) or 403.12(l)(2);

(ii) The authorization specifies either an individual or a position having responsibility for the overall operation of the facility from which the Industrial Discharge originates, such as the position of plant manager, operator of a well, or well field superintendent, or a position of equivalent responsibility, or having overall responsibility for environmental matters for the company; and

(iii) The written authorization is submitted to the Control Authority.
d) If an authorization under 40 CFR 403.12(l)(3) is no longer accurate because a different individual or position has responsibility for the overall operation of the facility, or overall responsibility for environmental matters for the company, the Industrial User must submit a new authorization satisfying the requirements of 40 CFR 403.12(l)(3) to the Control Authority before or together with, any reports to be signed by an authorized representative.

4.2.2 Accuracy

A permit application must be accurate. In other words, not only should the application be complete and contain all the necessary information, but it must also be correct. While it might be difficult to detect certain inaccuracies, a number of common mistakes can be readily detected. When mistakes are detected, the permittee must correct them. The permit writer should follow the same procedures to correct inaccurate information as were used to obtain missing information. The examples in Table 4-2 illustrate the type of review that the permit writer must conduct.

In verifying the Industrial User's information, particular attention should be given to the following:

- Information on the use, production, and discharge of toxic substances
- Information on all wastestreams (including schematic flow diagram(s) and waste characterization of individual wastestreams)

Accurate information on the use or production of toxic or nonconventional pollutants at a facility and adequate sampling data on such pollutants in the facility's effluent are essential for preparing appropriate permit limits. Industrial Users should provide a comprehensive list of toxic substances used, produced (as products, by-products, or intermediates), and stored and identify the toxic substances known or suspected to be present in the wastestream.

If the Industrial User lists toxic substances but does not indicate their potential presence in the wastestream, an explanation for their absence from the wastestream should be provided. Specific constituents of trade name products or compounds should be obtained from manufacturers. Facility inspections should be conducted to verify this information by inspecting all storage areas and reviewing material safety data sheets.

The permit writer should also verify schematic diagrams of facility operations and internal wastewater streams by inspecting the facility. If the facility is subject to categorical Pretreatment Standards, the permit writer should pay attention to identifying which wastestreams are regulated by the categorical standards, which wastestreams are not, and where any wastestreams might combine. Proper classification of the various wastestreams and accurate flow data on the individual wastestreams are critical to calculating correct effluent limits.

Facility inspections may include dye testing as a method of verifying piping diagrams or identifying where piping diagrams do not exist. Developing a water balance (as discussed in Table 4-3) using the water and wastewater flow data provided by the Industrial User can determine whether all wastestreams have been accounted for and whether flow data are accurate. If discrepancies exist, the Control Authority should collect actual flow measurements to gather more accurate data.

4.2.3 Background Information Review

To help evaluate the completeness and accuracy of the permit application, the permit writer should consider any additional background information on the facility that might be relevant. Much of this information might already be available in the Control Authority's Industrial User files. Pertinent background information to consider includes the following:

- ***Current permit and rationale for the current permit***—The permit writer should be aware of the parameters regulated, the basis for setting effluent limits (i.e., any change in processes or categorical wastestreams), and any BMPs required of the discharger. This information will alert the permit writer to pollutants previously thought to be of concern and the monitoring requirements deemed appropriate. In addition to reviewing the Industrial User background information, the permit writer should consider whether changes in the treatment plant's operation, its NPDES permit conditions and its sludge disposal practices and limitations could affect the industry's permit conditions. If the conditions under which specific discharges were permitted have not changed since the last permit application, there is little reason for drastic changes to the conditions for that discharge, assuming the previous permit was developed properly. Exceptions to this include cases where a record of problems or noncompliance exists at the facility, as discussed below.
- ***Old permit application, BMR, and industrial waste surveys***—Information in such documents can be used (1) to establish past operating practices and conditions; (2) as a baseline for evaluating the new application; and (3) to identify changes.
- ***Compliance inspection reports, sampling data, and self-monitoring reports***—Such reports can provide the permit writer with information regarding possible causes for any permit violations, indicate how well wastewater treatment units are operated, and provide insight as to the discharger's commitment to environmental compliance. Information gathered from the reports such as evidence of spills or poor operation and maintenance of a treatment system can also provide a basis for the requirement of Industrial User management practices as a permit condition. If the reports reveal any changes in the facility's operations such differences should be noted and verified. If the changes in the facility's operations are not noted in the latest application, any discrepancies should be resolved to the permit writer's satisfaction before a permit is issued.

  Review and evaluation of sampling data are important because the data can indicate how consistently the permit limits have been met. This information can be relevant in establishing monitoring frequencies required in the new permit. Changes in monitoring data or compliance can also indicate possible changes at the facility.

  The permit writer must review sampling data and document such an evaluation to provide a sampling waiver, to determine qualifications under a general control mechanism, or to reclassify the facility as an NSCIU or middle-tier categorical industrial user (MTCIU).
- ***Correspondence concerning compliance or enforcement actions***—This information can alert the permit writer to the occurrence and resolution of compliance problems and can be used to help the permit writer determine monitoring frequencies and special conditions.

  The permit writer can obtain additional information on the industrial processes and pollutants that might be present by reviewing national categorical pretreatment regulations, related development documents, reference text books on specific industry categories, and information from other environmental permit programs such as the Resource Conservation and Recovery Act (RCRA) and the Clean Air Act. As needed, the permit writer should request supplemental information from various state agencies, EPA Regional offices, EPA's Office of Enforcement and Compliance Assurance (Compliance Assistance and Sector Programs Division), and the applicant.

4.2.4 Facility Inspection Introduction

As mentioned earlier, EPA recommends that the permit writer conduct a facility inspection (including taking pictures) to verify application information and to gain an understanding of the Industrial User's facilities. The inspection should encompass a review of the following:

• ***Facility information***—This review will ensure that the facility information such as the facility address (physical location versus mailing location) and the location of the sampling point is correct in the permit and permit files.

• ***Production processes***—This will help the permit writer identify the following:

- – Applicable categorical Pretreatment Standards
- – Toxic or hazardous substances that might be present in raw materials, products, and by-products that have the potential to be present in the industry's discharge
- – Water uses and resulting wastewater streams
- – Existing in-process pollution controls
- – Potential for spills and leaks

From such information, the permit writer can select pollutants to be limited or require development of additional in-process controls.

• ***Sewer layout of the plant***—If a sewer plan exists, the permit writer should review the plan thoroughly to determine the course and destination of each sewer line. He or she should identify the exact source of and the point at which each wastestream enters the sewer. The permit writer should also delineate the existing monitoring point or any potential location for monitoring. Where sewer plans do not exist, he or she should perform smoke or dye testing to locate all points of discharge to the sewer system. This information will be used to determine the appropriate sampling points, to ensure that all points of discharge to the sewer system will be identified in the permit, and to evaluate the need for application of the CWF.

• ***Wastewater treatment facilities, including treatment performance and operation and maintenance practices***—Such information can be used to evaluate the adequacy of existing treatment, to assess the feasibility of improvements, and to evaluate performance data.

• ***Types of batch discharges that occur at the facility***—This information could affect the design of the monitoring requirements. Cleanup operations usually result in batch discharges of washdown water. Permit writers should obtain information about cleanup times and water volumes.

• ***Raw material and product storage and loading areas, sewage sludge storage and disposal areas, hazardous waste management facilities (if applicable) including on-site disposal areas and all process areas, and the proximity of such areas to sewer discharge points***—This review will help to identify potential pollutants and potential or known problems with spills or leaks. The information is then used to determine the need for additional controls by establishing specific Industrial User BMPs (i.e., slug discharge control plans, toxic organic management plans, and good housekeeping practices).

• ***Sampling points, sampling methods, and analytical techniques***—This information is necessary to determine appropriate limits to apply at different locations, whether internal monitoring points should be established, and to evaluate the quality of both the Control Authority's and the Industrial User's sampling data.

An adequate inspection of a facility could require a full day or more to conduct. Complex plants with several treatment systems, numerous sewer connections and associated waste delivery piping, and extensive ancillary activities might require more than one day to inspect. For guidance on the performance of inspections, see the *NPDES Compliance Inspection Manual* and EPA's *Industrial User Inspection and Sampling Manual for POTWs*.

4.3 Public Access to Information

Certain information collected through a permit application form and industrial monitoring reports must be made available to the general public upon request [40 CFR 403.14(b)]. The following information is defined as *effluent data* at 40 CFR Part 2 of EPA's regulations and must always be available to the public:

General description of the location and nature of the source to the extent necessary to identify the source and distinguish it from other sources (including, to the extent necessary for such purposes, a description of the device, installation, or operation constituting the source)

- Information necessary to determine the identity, amount, frequency, concentration, temperature, or other characteristics (to the extent related to water quality) of the pollutants that, under an applicable standard or limitation, the source was authorized to discharge (including, to the extent necessary for such purpose, a description of the manner or rate of operation of the source)
- Information necessary to determine the identity, amount, frequency, concentration, temperature, or other characteristics (to the extent related to water quality) of any pollutant that has been discharged
- Production data at facilities subject to production-based categorical pretreatment standards. [Reference: RSR Corp. v. Browner, 1997 U.S. Appeals LEXIS 5523 (2nd Cir. Mar. 26, 1997)]

While the effluent data must be made available to the public, other data submitted by Industrial Users may be claimed *confidential* and withheld from public scrutiny. The Control Authority, however, must release information submitted under a claim of confidentiality to the Approval Authority and EPA (if different) whenever requested to do so. To guarantee that effluent data remain available for public review, the ordinance should specifically state that effluent data [as defined in 40 CFR 2.302(a)(2)] will not be considered confidential under any circumstances.

The ordinance may also provide that proprietary information or trade secrets will be entitled to consideration by the Control Authority for possible confidential treatment (provided that such information is not *effluent data*) if the Industrial User stamps *Confidential Business Information* over all parts for which protection is sought. When confidentiality is requested, the Control Authority may make an immediate determination as to whether to grant the request or defer making a determination until the Control Authority receives a request to provide the information to the public.

If the Control Authority determines, when it first receives the request for confidentiality, that the information is not entitled to confidential treatment, the Control Authority should notify the Industrial User verbally and then by written notice of the denial of confidentiality status. The written notice may be made by certified mail with return receipt requested, by personal delivery, or by other means that allow verification of receipt and the date of receipt. This written notice should provide an opportunity for the Industrial User to appeal the decision within 15 days.

If the Control Authority determines that the information is confidential (or if it is being treated as confidential pending a final determination), the Control Authority should separate the information from the rest of the permit file and keep it in *limited access* (lock and key) status.

This will typically require creating a second file for each user that contains additional confidential materials. Access to the special information should be safeguarded, even against Control Authority employees who have no legitimate reason for access to such materials. If such information is turned over to EPA, the confidential information will receive such protection as is afforded by 40 CFR Part 2.

All information that is not *specificall*y identified as confidential (or that is later determined by the Control Authority not to be entitled to confidential treatment) should be available to the public upon request.

If the Control Authority defers the determination of confidentiality until public access to the information is requested, the Control Authority should notify the Industrial User of the request, inform the Industrial User of the preliminary determination, and provide an opportunity for the Industrial User to appeal.

The Control Authority should allow a period of no less than 15 days for the Industrial User to respond. If the Industrial User does not respond, the Control Authority may release the information (if the information was not entitled to confidentiality) or deny the request to provide the information (if the information is considered confidential).

It is important that the Control Authority keep public information in an orderly and complete manner and protect against theft or destruction of valuable documents. Therefore, the Control Authority should develop a *request system* that will create a permanent record of the information requested and the person(s) handling and receiving the information.

Such a system might function similarly to a checkout system at a public library and would enable the Control Authority to identify persons looking at the file if a portion of it was ever missing. In fact, the Control Authority should have photocopying services available on-site to prohibit files from being taken off the premises.

Topic 4- Permit Applications Section Post Quiz

What Information to Collect and How to Collect it

1. The Control Authority should have the legal authority to require an Industrial User to complete and file a permit application to receive a_________________________.

2. Control Authority should consider requiring an existing permittee to submit an application with updated information for a________________. The permit application serves as the formal request from the Industrial User to the Control Authority to connect or discharge to the sewer system.

3. The permit application format should be standardized so that all necessary information is requested but should also allow the applicant the leeway to include narrative information. The Industrial User should be required to provide manufacturing process flow and wastewater characteristics, and information regarding any___________________.

4. Other information, such as number of employees, list of chemicals used or stored, and ______________________, is also vital to the permit writer.

5. The number of employees can indicate the estimated volume of sanitary flow, and the list of chemicals used by the facility can indicate potential pollutants present in the _______________.

6. This information can lead to a better understanding of the facility's operations, which, in turn, enables the permit writer to evaluate the Industrial User's discharge comprehensively and to develop adequate and _______________________.

7. If the Control Authority does not require an Industrial User to complete a permit application to receive a permit, the Control Authority could compile the necessary information to draft a permit by reviewing the ________________________ (if the user is a CIU), reviewing historical effluent data, or conducting a site inspection of the user's facility.

Application Review Process

8. Instructions provided to the Industrial User on how to complete the __________________ should state that all items must be completed and that the term *not applicable* should be used to show that the item was considered but was not pertinent to the facility.

9. If changes or corrections to any application are extensive, the Control Authority should exercise its information gathering authority to request a revised, complete application instead of an incomplete application that is later augmented with___________________.

10. Pollutant data on the final effluent might not always be adequate for complex facilities where internal wastestreams can be diluted by large volumes of _________________ before the sampling point.

11. A review of ________________________will allow the permit writer to decide what pollutants warrant limits or monitoring requirements or both. The permit writer should not hesitate to require any supplementary information (such as more detailed production information or monitoring data) needed to develop the permit.

Accuracy

12. Accurate information on the use or production of _______________at a facility and adequate sampling data on such pollutants in the facility's effluent are essential for preparing appropriate permit limits.

13. Industrial Users should provide a comprehensive list of toxic substances used, produced (as products, by-products, or intermediates), and stored and identify the toxic substances known or suspected to be present in the_______________________.

14. If the Industrial User lists ___________________but does not indicate their potential presence in the wastestream, an explanation for their absence from the wastestream should be provided.

15. Specific constituents of trade name products or compounds should be obtained from manufacturers. Facility inspections should be conducted to verify this information by inspecting all storage areas and reviewing_________________________.

16. The permit writer should also verify schematic diagrams of facility operations and internal wastewater streams by inspecting the facility. If the facility is subject to categorical Pretreatment Standards, the permit writer should pay attention to identifying which wastestreams are regulated by the___________________ , which wastestreams are not, and where any wastestreams might combine.

17. Proper classification of the various wastestreams and accurate flow data on the individual wastestreams are critical to calculating___________________ .

18. Facility inspections may include dye testing as a method of verifying ______________ or identifying where piping diagrams do not exist.

19. Developing a ____________________ using the water and wastewater flow data provided by the Industrial User can determine whether all wastestreams have been accounted for and whether flow data are accurate. If discrepancies exist, the Control Authority should collect actual flow measurements to gather more accurate data.

Current permit and rationale for the current permit

20. The permit writer should be aware of the parameters regulated, the basis for setting effluent limits (i.e., any change in processes or categorical wastestreams), and any _______________ required of the discharger.

Topic 5 - Permitting Considerations Section

Topic 5 - Section Focus: You will learn the basics of the pretreatment program, POTW rules, industrial/commercial classifications and inspection procedures. At the end of this section, you will be able to understand and describe Clean Water Act's rule concerning pretreatment and the rational for pretreatment. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 5 – Scope/Background: The Industrial Pretreatment program is a federally mandated program under the Clean Water Act, which controls the discharges of commercial and industrial facilities. The purpose of the pretreatment program is to block the introduction of pollutants, which can cause damage to equipment and interference with the wastewater treatment process, into the wastewater collection and transmission system. The program is important in preventing harm to workers, the public and the environment.

5.1 Contents of a Permit

Once complete and accurate information is obtained and verified, the next step in the Industrial User permit development process is for the Control Authority to draft the actual permit. At a minimum, the permit should consist of the following elements:

- Cover page
- Effluent limits
- Monitoring requirements
- Reporting requirements
- Standard conditions
- Additional conditions where necessary to adequately regulate the discharge

Such elements are set out in a sample permit in Appendix E, and sample standard conditions are provided in Appendix F. Those appendices illustrate many of the concepts discussed in this Topic. Before the six elements are discussed in more detail, some general considerations need to be emphasized: the care that the permit writer should take in the structure and wording of the permit; common permitting errors or omissions to avoid; the flexibility of the permit; and the importance of documenting all permit decisions.

5.2 Structure and Wording

The structure and wording of a permit directly affect the Control Authority's ability to invoke its various enforcement options successfully. For this reason, the permit writer should follow three general rules:

- Use specific language
- Develop concise and complete discharge conditions and requirements
- Write as clearly and simply as possible (please refer to www.plainlanguage.gov for more information)

The permit writer should avoid vague, weak, or obtuse language that could undermine the permit's enforceability. The list below shows appropriate language to use in the permit.

To Express	Use
is required to	**must**
Is required not to, is not allowed	**must not**
has discretion to, is permitted to	**may**
is not permitted to	**may not**
ought to	**should**
future contingency	**will**

The permit writer should also avoid long and confusing requirements. However, the permit writer should not be so brief as to leave out vital specifics.

A permit frequently acts as the principal notification to the Industrial User of its responsibilities for compliance. Therefore, permit requirements must be clear and simple to understand.

5.3 Common Permitting Errors and Omissions

The permit writer should keep in mind that any of the following errors and omissions in the permit might cause it to be susceptible to legal challenge, to fail to properly regulate the Industrial User, or to be misleading or confusing to the permittee:

- Failure to correctly calculate and apply effluent limitations from applicable Pretreatment Standards
- Failure to apply the most stringent limit (federal categorical Pretreatment Standard, state requirement, or local limit)
- Failure to regulate all discharge points
- Omission of standard conditions
- Failure to specify adequate monitoring or analytical requirements, including a failure to identify specific monitoring locations
- Use of ambiguous or inappropriate permit commands, such as *recommended*, *shall*, and *expected* rather than *may*, *may not*, *will*, *must*, *must not*, and *should*, (for appropriate use of these, see the list in section 5.2)
- Failure to incorporate specific citations to requirements contained in an ordinance or regulation, where the requirements are not otherwise set forth in the permit
- Failure to specify the signatory requirements for self-monitoring reports and other notification requirements
- Failure to account for any known seasonal changes or other predictable variations in the effluent

5.4 Flexibility

Specific conditions within each permit element should be tailored to the Industrial User for which the permit is intended. While it might be obvious that very dissimilar Industrial Users will need different permit conditions, even similar Industrial Users could need permit conditions tailored to site-specific discharge situations.

Certain permit conditions are not flexible and cannot be modified. For example, the permit writer cannot modify categorical Pretreatment Standards and Requirements or the general and specific prohibitions in 40 CFR 403.5. The following are federal requirements that must be imposed on Industrial Users where they apply:

- Those conditions based on federal Pretreatment Standards and Requirements, including any BMP requirements
- Use of the CWF or flow-weighted averaging formula to derive appropriate limits for CIUs where applicable
- Requirement to follow analytical methods in 40 CFR Part 136 or other EPA-approved methods for wastewater analyses

The permit writer cannot modify any Industrial User permit or general control mechanism conditions mandated by state law or local ordinance, such as the following:

- Those conditions based on state Pretreatment Standards and Requirements (unless otherwise specified)
- Standard conditions adopted by the Control Authority
- The Control Authority’s ability to modify or terminate the permit during its effective period
- The extent of the permittee’s enforcement liability if noncompliance occurs

Flexibility is provided, however, in the drafting process allowing the permit writer to analyze comments and modify portions of the permit. Situations (depending on legal authority) that could result in modified permit conditions include the following:
• Wastewater flow rate [Note: Modifications to the wastewater flow rate must not exceed the flow used in the development of the approved maximum allowable industrial loading. In addition, if an Industrial User is classified as an MTCIU, its flow rate modification must not exceed the following:
– 0.01 percent of the design dry-weather hydraulic capacity of the POTW, or 5,000 gpd, whichever is smaller,
– 0.01 percent of the design dry-weather organic capacity of the POTW; and
– 0.01 percent of the maximum allowable headworks loading (MAHL) for any pollutant regulated by the applicable categorical Pretreatment Standard for which approved local limits were developed by the POTW in accordance with 40 CFR 403.5(c).]

- Production rates
- Pollutants of concern other than those addressed by Federal, State, or local regulations
- Monitoring location
- Monitoring frequency
- Special conditions
- Effective period (a maximum of 5 years)

5.5 Documenting Permit Decisions
Throughout the permit drafting process, the permit writer should carefully and thoroughly document each step for several reasons. First, it will help the permit writer develop the permit thoroughly and logically.

Second, it will facilitate defending any challenges that the permit terms and conditions were developed arbitrarily or capriciously.

Third, it will provide the required documentation in the permit record of any relief from otherwise applicable requirements (i.e., pollutants not expected to be present, equivalent limits, decisions on general control mechanisms, decisions on NSCIU classification, and decisions on reduced monitoring requirements). Finally, careful documentation makes future permit reissuance easier, particularly if a new permit writer is responsible for permit reissuance.

5.6 Components of the Cover Page

The most basic and, therefore, most frequently overlooked portion of a permit is the cover page. However, drafting the cover page improperly could have significant ramifications regarding permit enforceability. An example of a cover page is in Appendix E.

5.6.1 Format

The cover page should have the appearance of a legal document. It is recommended that the cover page appear on official agency letterhead or stationery or on a special permit form.

5.7 Elements of the Cover Page

The cover page should contain the following:

• ***Name and address of the permittee***—The correct and legal name of the permittee and the facility's physical location address. The mailing address can also appear on the cover page.

• ***Citation to legal authority***—A specific citation to the Control Authority's legal authority to issue and enforce permit provisions.

• ***Duty to comply***—The permittee's duty to comply with all applicable federal, state, and local laws even if they are not specifically incorporated into the permit.

• ***Reapplication requirements***—The permittee's duty to reapply for continuation of the permit before the expiration date.

• ***Effective period***—The permit's effective date and expiration date must be clearly set out. If the permit's or general control mechanism's effectiveness is to begin on a date other than the one on which it was signed or issued by the Control Authority, that effective date should appear clearly on the cover page. In addition, the date on which the permit or general control mechanism is signed should be on or before the effective date. Although Control Authorities may establish shorter durations, the effective periods must not extend more than 5 years into the future for SIUs.

• ***Signature of Control Authority***—The permit must be signed and dated only by a Control Authority official authorized to issue permits. Failure to sign and date the permit properly might call its validity into question at a later date. In addition, to avoid any possible misunderstanding that the permit is some form of contract, the Industrial User should not sign the permit. For a further discussion, see Topic 3. The cover page should also clearly state that a violation of any permit provision is a violation of the Control Authority's sewer use ordinance (or applicable state law) and could subject the permittee to enforcement action. In addition, if the ordinance requires the Industrial User to have a permit before it can begin its discharge, the cover page should indicate that the permit allows or grants the Industrial User permission to discharge to the sewage system.

PRETREATMENT PROGRAM EVALUATION EXAMPLE

1. Has a change in contributing jurisdictions occurred since the last Annual Report?
   Yes No
   If yes, identify the jurisdictions that have been added or removed: ____________________
   ____
   ____

2. Has the Control Authority updated its Industrial Waste Survey (IWS) to identify new Industrial Users (IUs) or changes in wastewater discharges at existing IUs? [(403.8(f)(2)(i)]
   Yes No
   If yes:
   a. Are any of these IUs located in new service areas (describe)? ____________________
      ____
      ____
   b. Have any IUs located in contributing jurisdictions where the POTW has no inter-jurisdictional agreements or IU contracts? Yes No
   c. If yes, specify: ____
      ____

3. For any <u>new</u> Categorical Industrial Users:
   a. Baseline Monitoring Report (BMR) Submitted? Yes No
   b. Final (90-day) Compliance Report (FCR) Submitted? Yes No

4. How many IUs are currently identified by the Control Authority in each of the following groups?

   ____________ TOTAL SIUs (as defined by Control Authority)
   ______________Categorical Industrial Users (CIUs)
   ______________Significant Non-categorical IUs
   ______________NDCIUs subject to zero discharge limits
   ____________ Other regulated non-categorical IUs (Describe):
   ____________ NDCIUs that are not subject zero discharge categorical limits

5. Is the Control Authority's definition of "**Significant Industrial User**" the same as EPA's? [403.3(t)(1)(i-ii)] Yes No

If not, the Control Authority has defined "**Significant Industrial User**" to mean: ___________

6. How many SIUs are required to be covered by an individual control mechanism? ___________

How many SIUs are not covered by an existing, unexpired permit or other control mechanism? ___________

Explain: ___________

7. Were individual control mechanisms issued/reissued for 90% of the SIUs within 180 days of the expiration date? Yes No

How many control mechanisms were not issued within 180 days of the expiration date? ___________

Explain: ___________

8. Does the Control Authority have a control mechanism for regulating IUs whose wastes are trucked to the treatment plant? Yes No N/A

If yes, does control mechanism designate a discharge point? Yes No

9. Are all applicable categorical standards and local limits applied to IUs whose wastes are trucked into the POTW? Yes No N/A

If not, why: ____

____

____

____

____

____

10. Has the Control Authority evaluated the need for SIUs to develop slug discharge control plans? [403.8(f)(2)(v)] Yes No

If yes, when was the evaluation last conducted and what criteria were used to identify the IUs for slug plans? ____

____

____

____

____

____

How many slug control plans were: Required? _________
Received? _________
Approved? _________

11. Are TTO standards or alternatives (solvent management plans or oil & grease monitoring) being implemented for IUs subject to TTO limitations? Yes No N/A

If not, why? ____

____

____

____

____

____

Are TTO standards being applied to other IUs? Yes No

12. How many times were the following monitored during the past year?

	Influent	Effluent	Sludge	Ambient (Receiving Water)
Metals				
Priority Poll.				
Biomonitoring				
TCLP				
EP Tox				
Other:				

13. How many, and what percentage of SIUs were (a) not sampled at least twice, or (b) not inspected at least once during the reporting period? [403.8(f)(2)(vi)]
    a. Number and % not sampled: ______ (_____%)
    b. Number and % not inspected: ______ (_____%)

14. Does the Control Authority routinely split samples with industrial personnel?
    a. If requested: ρ Yes ρ No ρ N/A
    b. To verify IU self-monitoring results: ρ Yes ρ No ρ N/A

15. Provide the following analytical information regarding pollutant analyses:

	Analytical Method	Name of Laboratory
Metals		
Cyanide		
Organics		
Other:		

16. Does the Control Authority use QA/QC for sampling and analysis? Yes No

    If yes, describe: ____
    ____
    ____

17. How much time normally elapses between sample collection and obtaining analytical results? ____________________

18. Is there an established protocol clearly detailing sampling location and procedures?
Yes No

19. Has the Control Authority had any problems performing compliance monitoring?
Scheduled Unscheduled Demand

If yes, explain: ____________________

20. How frequently does the Control Authority use the closed cup flashpoint test, specified in 40 CFR Part 261.21, to monitor SIUs? [403.5(b)(1)]
______Once per year
______Prior to each sampling
______Other: ____________________

Did the Control Authority find any problems? Yes No

If yes, explain: ____________________

21. Does the Control Authority compare all monitoring data to applicable pretreatment standards and requirements contained in the control mechanism within 15 days of its receipt? [403.8(f)(2)(iv)] Yes No

22. Does the Control Authority use EPA's definition of Significant Noncompliance (SNC)? [403.8(f)(2)(vii)] Yes No

23. Are SIUs required to notify the Control Authority within 24 hours of becoming aware of a violation and to submit additional monitoring within 30 days after the violation is identified [403.12(g)(2)] Yes No N/A

If the Control Authority conducts monitoring in lieu of the user, does the Control Authority resample and obtain results within 30 days of identifying a violation?
Yes No N/A

24. Has the Control Authority developed an Enforcement Response Plan? Yes No

25. For each of the listed enforcement actions, identify the following for the ones the Control Authority has used <u>during the reporting period</u>:

	Total # of Actions	# of Industries Affected
Written notice or letter of violation		
Administrative orders		
Administrative fines		
Show cause hearings		
Compliance orders		
Permit revocation		
Civil action		
Criminal action		
Termination of service		
Other (specify):		

26. Indicate the number and percent of SIUs that were identified as being in SNC (as defined by EPA) with the following <u>during the reporting period</u>:

	# of SNC SIUs	% of SNC SIUs
Applicable pretreatment standards [PSNC]*		
Self-monitoring requirements [MSNC]		
Reporting requirements [PSNC]*		
Pretreatment compliance schedule [SSNC]		
Other:		

27. Did the Control Authority publish all SIUS in SNC in the largest daily newspaper? [403.8(f)(2)(vii)] Yes No

If yes, attach copy, or attach copy of affidavit of publication.

28. Indicate the number of SIUs that are currently in SNC with self-monitoring and were not inspected or sampled: ______________________________

29. Has the Control Authority experienced any of the following?

	Yes	No	Unknown	Explain:
Interference				
Pass through				
Fire or explosions (including flash point violations)				
Corrosive structural damage (including pH<5.0)				
Flow obstructions				
Excessive flow or pollutant concentrations				
Heat problems				
Interference due to oil or grease				
Toxic fumes				
Illicit dumping of hauled waste				

30. How many SIUs are currently on compliance schedules in order to meet new or revised national pretreatment standards or requirements?____________________

Have any CIUs been allowed more than 3 years from the effective date of a categorical standard to achieve compliance? [403.6(b)] es No

31. Indicate the number of SIUs from which penalties have been collected by the Control Authority during the past year:

	Number	Amount ($)
Civil		
Administrative		
Total		

32. Have IUs requested that data be held confidential? Yes No

33. Have any requests been made by the public to review files? Yes No

34. Has public comment been solicited during revisions to the SUO and/or local limits since the last PCI or audit? [403.5(c)(3)] Yes No N/A

35. Are there significant public or community issues impacting the POTW's pretreatment program? Yes No

If yes, explain:____________________

36. Are all records maintained for at least 3 years? Yes No N/A

37. Have any problems in program implementation been observed which appear to be related to inadequate funding, resources or staff? Yes No

If yes, explain:

38. Does the Control Authority have the technical documents necessary for implementing its pretreatment program? Yes No

39. Does the Control Authority have access to adequate:

	Yes	No	Explain:
Sampling equipment			
Safety equipment			
Vehicles			
Analytical equipment			

PERMIT COVER SHEET EXAMPLE

Control Authority Name: ____

Treatment Plant Name(s): Permit Number(s):

____ ____________

____ ____________

____ ____________

____ ____________

____ ____________

Pretreatment Contact: ______________________________

Title: ______________________________

Address: ______________________________

____

____

City, State, Zip Code: ______________________________

Telephone: ______________________________

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 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.

____________________________________ ____________

POTW Authorized Signatory Date

____

Title

PROGRAM UPDATE EXAMPLE

1. Approval Date of Original Pretreatment Program:

2. Program Materials Under Development (Date Planned for Submission):

3. Program Materials Submitted for Review/Approval (Date Submitted):

4. Program Materials Approved (Date Approved/Date Incorporated into NPDES Permit):

5. Additional Noteworthy Pretreatment Activities/Accomplishments:

LIST OF REGULATED USERS

Name of User	SIU (Y/N)	CIU (Y/N)	40 CFR Part No.	NDCIU (Y/N)	SIC Code	Permit Issued (Y/N)

INDUSTRIAL SURVEY UPDATE

Name of Industry	Survey Returned (Y/N)	Permit Application Required (Y/N)	Permit Application Returned (Y/N)	Permit Issued (Y/N)	Comments

COMPLIANCE/OVERSIGHT SUMMARY
(SIUs ONLY)

Name of SIU	Permit Expiration Date	Number of Documented Inspections	POTW Sampling (All Regulated Pollutants)	SIU Self-Monitoring (All Regulated Pollutants)	SNC for Quarter[1]			
					1	2	3	4

B – SNC with Self-Monitoring Requirements
C – SNC with Reporting Requirements
D – SNC with Compliance Schedule

NONCOMPLIANCE/ENFORCEMENT SUMMARY
(SIUs ONLY)

Name of SIU	Nature of Violation	Date of Violation	POTW Enforcement Response	Date of POTW Response	Date of Return to Compliance	Comments

Examples of Regulatory and Compliance Letters

January 13, 2022

Mr. D. Robert Kelly
Ajax Well Repair, Inc.
8111 East Montebello Drive
Phoenix, Az. 85777

Dear Mr. Kelly:

RE: DISCHARGE OF WELL MONITORING WATER AT ACME'S PEORIA AVENUE FACILITY

I am in receipt of your letter dated December 4, 2021, in which you requested to discharge approximately 3000 gallons of groundwater generated during the sampling operations of MW-1a thru MW-9 located at, and in the immediate vicinity of, the Acme Peoria Avenue facility, 2250 West Peoria Avenue. The groundwater withdrawn from monitoring wells located at this site is part of a Remedial Investigation / Feasibility Study required by the Arizona Department of Environmental Quality.

Approval is hereby granted for the discharge of approximately 3000 gallons of well purge water. This discharge is anticipated to occur sometime during the period of December 11, through December 16, 2021, to City of Sunflower manholes 124 and 125 in Quarter Section 30-24, and manholes 302 and 403 in Quarter Section 29-23. This discharge shall not exceed a flow rate of 50 gallons per minute, in order to avoid hydraulic overloading of the sewer mains in the area.

This approval is based on a thorough review of the historic analytical data submitted in your letter of September 27, 20215 and 2nd Quarter water quality results submitted with the December 4, 2014 letter. Our review indicates, the Toxic Organics were analyzed using EPA methods 601. All VOC concentrations were found to be less than the Sunflower City Code Instantaneous Effluent Limitations.

It is the opinion of the City of Sunflower Water Quality Division that the wastewater meets all requirements under Chapter 28. The wastewater is also determined not to be in sufficient quantity to injure or interfere with any sewage treatment process, cause corrosive structural damage, constitute a hazard to humans, or create any hazard to the sewer system, or in the receiving waters of the sewage treatment plant.

Please submit your final status report within ten (10) days of the date of discharge. This report shall include the date(s) of discharge, time of day this discharge occurred, and the total gallonage.

Please review the permit thoroughly. Should you have any questions, please contact me at 534-1362. Our office hours are 8:00 a.m. to 5:00 p.m., Monday through Friday.

Sincerely,

MANHOLE ENTRY PERMIT Example

The City of Sunflower, acting through the Water and Wastewater Department, hereby issues a manhole permit to:

Ajax Well Repair, Inc.
8111 East Montebello Drive
Suite 116
Tempe, AZ. 85281

Hereinafter called Permittee, for the purpose of entering City of Sunflower manhole nos. 124 and 125 in Quarter Section 30-24 and manhole nos. 302 and 403 in Quarter Section 29-23 to dispose groundwater brought to the surface during monitor well pumping test operations at and in the immediate vicinity of:

Acme's Peoria Avenue Facility
7574 West Culver Avenue
Sunflower, Arizona

Prior results from laboratory chemical analyses, from December, 2011 to June, 2021, indicate that concentrations of volatile organic compounds are less than 1000 micrograms per liter. Monitor well water will be sampled and analyzed for volatile organic compounds using EPA methods 601/602 and method 624 for purgeable volatiles. Discharge to the sewer must not exceed 50 gallons per minute, in order to avoid hydraulic overloading of the sewer mains in the area.

The manhole entry permit is issued subject to the following conditions:

1. That the only activities authorized by the permit are for the purposes of removal of the contained wastewater, and that the Permittee conduct no other activity while entering upon the public property authorized by this permit.

2. That the Permittee's activities be conducted only within the time period of December 11, through December 16, 2021, unless authorized in writing by the Water and Wastewater Director for an extension of time, or unless revoked earlier, and that the Permittee notify the Water and Wastewater Department in advance of each separate entry.

3. Permittee shall submit analytical results as established in Section 3 of this permit within 10 days of completing discharge of development and purge waters.

4. Permittee shall incur costs of $1.0255 per one hundred cubic feet (or current rate as established by water accounting) of ground water discharged.

5. That the Permittee, when finished with the removal and discharge activities, replace to the satisfaction of the Water and Wastewater Director, any manhole covers or other

disturbances to the City of Sunflower sewer lines that he caused during the course of his activities.

6. That the Permittee agrees to save and hold harmless, the City, any of its departments, agencies, officers or employees from all costs and damages occurred by any of the above from any damage to any person or property whatsoever which is caused by the activity, condition or event arising out of the negligent performance or nonperformance of any of the provisions of this permit by the Permittee any of the Permittee's agents, or any of the Permittee's independent contractors. The above costs incurred by the City, any of its departments, agencies, officers or employees shall include in the event of any action, court cost, expensive litigation and reasonable attorney fees. When any of the above costs and/or damages occur as aforesaid, the Permittee assumes the burden of proof that the negligent activity, condition or event did not cause such cost damage or other expense the City may incur.

The Permittee agrees to the condition set forth in this permit, and understands that all activities done under the conditions of this permit should conform to the laws of the City of Sunflower and the State of Arizona.

Dated this ________ day of __________________, 2021.

____
Permittee

Dated this ________ day of __________________, 2021.

CITY OF SUNFLOWER,
a municipal corporation

By: __________________________________
Chris Stevens
Chief Water Quality Inspector
Water Services Department

MANHOLE NO.	QUARTER SECTION	DESCRIPTION OF LOCATION
MH 124	30-24	5 feet west of center line in 21st Avenue approximately 150 feet north of center line of Fred Street. For monitor well MW-6.

September 15, 2019

Mr. Dewey Hopkins, President
Acme Technical Casting, Inc.
8111 East Montebello Street
Sunflower, Arizona 85040

Certified Mail
Return Receipt Requested

Re: Confirmation of Wastewater Discharge Permit Reclassification From Class A to Class B

Dear Mr. Myers:

I am writing this letter to acknowledge your meeting on August 29, 2019 with Chris Binder, Chief Water Quality Inspector, and to confirm the City of Sunflower' (City) decision to reclassify the permit status of Acme Technical Casting, Inc. (Acme) from "***Class A***" to "***Class B***." While the reasons forming the basis for this decision were briefly discussed at the meeting, I believe it necessary to recite them here so that Acme thoroughly understands why the City made this decision.

BACKGROUND INFORMATION

The information contained in this portion of my letter is based upon documentation contained in our file, observations made by City Water Quality Inspectors during on-site inspections and various meetings with Acme representatives.

Acme manufactures investment castings for commercial and aerospace applications using ferrous and non-ferrous metals. Pretreatment consists of a closed loop recirculating filtration system. There is no categorical discharge to the sanitary sewer. Any sludge resulting from the manufacturing process is disposed of accordingly.

There are no floor drains in the production area. The floor is bermed and sloped to a sump in the pretreatment area. All categorical process discharge lines have been cut and plugged. This has been verified by on-site inspections performed by City Water Quality Inspectors. The wastewater discharge of approximately 4000 gallons per day (gpd) consists of non-federally regulated penetrant and X-ray rinses, in addition to sanitary wastes.

Even though the manufacturing operation is regulated by the 40 CFR 464.15(f) and 40 CFR 464.36(e)(2), metal molding and casting category, there is no discharge of this process wastewater to the sanitary sewer. Therefore, Acme does not conduct any activities that are regulated by the federal categorical standards contained in 40 CFR Chapter I, Subchapter N (parts 405-471). However, Acme is required to comply with 40 CFR 403 and Chapter 28 of the Sunflower City Code. Acme has been permitted as a Significant Industrial User (**SIU**) since June 24, 2019.

Acme has had two effluent violations in the past four years. Both were for exceeding the silver limitation, and the last violation occurred on September 5, 2016. Acme received the Mayor's Award recognizing full compliance with pretreatment requirements for the year 2018.

The total daily poundage from the biological oxygen demand (BOD) and suspended solids (SS) concentrations of the process wastewater is approximately 9.5 pounds. This is substantially less than the equivalent strength of 25,000 gpd of domestic waste when measured by BOD and SS (approximately 75 pounds).

PERMITTING STRUCTURE

As you know, the wastewater discharge permitting requirements are contained in Chapter 28 of the Sunflower City Code. When Acme was first issued a permit, the City only issued permits to SIU's. Due to its federal categorical discharge flows, Acme was designated in 1997 as a SIU. The City has since revised its permitting structure to allow for the issuance of non-SIU permits to other industrial users. The SIU permits are designated as Class A, with the non-SIU permits falling into the Class B category.

DECLASSIFICATION ANALYSIS

When a SIU permit is up for renewal, or when the City is made aware of changes made by the SIU that could change the status of the existing Class A permit, the City reviews all relevant information to determine (1) whether the SIU should continue to be classified as a SIU and therefore be issued a Class A permit; or (2) whether the industrial user qualifies for a Class B Permit. A Class B permit generally contains less restrictive requirements than a Class A permit.

Section 10-45.1 of the City Code allows industrial users to be issued a Class B permit if they: (1) are a zero process discharge user; (2) discharge the equivalent strength of 25,000 gallons per day of domestic waste as measured by BOD (Biological Oxygen Demand) and SS (Suspended Solids); (3) discharge polluted groundwater; or (4) discharge any of the substances identified in Sections 28-9 and 28-45(b) of the City Code.

Eligibility for a B permit is for those users discharging less than 25,000 gpd of process wastewater and there are no discharges of any federal categorical process wastewater. It is evident from the Background Section of this letter that Acme met this threshold requirement.

Our next step was to gather and evaluate additional information to determine whether Acme discharges causes or has the reasonable potential to cause harm or damage to the City's wastewater treatment plants, worker safety, public safety or to the environment. Without going into detail over everything that was considered, we did ask ourselves the following questions:

1. What is the average annual water consumption at the facility?

2. What are the process wastewater biological demand and suspended solids concentrations?

3. What types of activities are conducted on the site?

4. Is there a reasonable potential for adversely affecting the City's wastewater treatment plant operation or for violating any pretreatment standard or requirement?

5. Does the discharge pose a health and safety concern to Water Services personnel?

6. What is the compliance history of the facility?

7. What is the existence and effectiveness of pretreatment used by the facility?

8. Has there been any receipt of any environmental awards (e.g., Mayor's Recognition of Achievement for Full Compliance With Pretreatment Requirements)?

9. Does the facility have a written policy or philosophy pertaining to environmental matters and is it being followed?

10. Has the facility always exhibited good faith efforts in complying with Chapter 28 requirements?

11. Is this a special discharge under Section 28-45.1 of the Sunflower City Code?

Based upon all of the foregoing considerations, the City has reclassified the permit status of Acme from a Class A permit to a Class B permit.

<u>WHAT RECLASSIFICATION MEANS TO YOU</u>

1) Effective July 1, 2019, Wastewater Discharge Permit No. 9405-2944 is rescinded. Acme is no longer designated as a Significant Industrial User under Section 28-45 of the Sunflower City Code.

2) On or before September 15, 2019, Acme will be issued a Class B Wastewater Discharge Permit.

3) Effective July 1, 2016, Acme will not be subject to the annual permitting fee contained in Section 28-39(h) of the City Code. This information will be provided to the City's Customer Service Division of the Water Services Department and any adjustments will be made on a future billing statement.

4) Acme will no longer be eligible for the Mayor's Recognition of Achievement Award for Full Compliance with Pretreatment Requirements since the award is only given to Class A permittees. However, the City is considering whether to have some type of award for Class B Permit holders.

5) Please be aware that even though Acme is not a SIU based upon the facts as they exist today, this designation can change if the basis for our decision to issue a Class B Permit is no longer valid. For example, changes in your zero discharge of categorical process wastewater status so that Acme now has categorical process wastewater flow to the sanitary sewer will require a reclassification and return to SIU status. The City will review your permit classification status on an annual basis, or more frequently if warranted under the circumstances.

CONCLUSION

Acme will receive a Class B wastewater discharge permit under our new permitting structure. We are confident that Acme will continue to be responsible and use sound and prudent judgment in the handling of its wastewater discharges.

Chris Binder, Senior Water Quality Inspector, is the inspector that has been assigned to your facility. Please feel free to contact him at 474-8888 should you have any questions pertaining to your new permit.

Sincerely,

Bill Fields
Water Quality Supervisor

HIGH STRENGTH DISCHARGE PERMIT EXAMPLE

Facility Name:	ACME Services Group of Sunflower
Facility Address:	8111 West Montebello Street Sunflower, Arizona 85297
Mail Address:	8111 West Montebello Street Sunflower, Arizona 85297

PERMIT EFFECTIVE DATE: **January 1, 2019**

PERMIT EXPIRATION DATE: **December 31, 2021**

In accordance with the Permit Application filed by **ACME Services Group (ACME)** on **01/02/19** with the City of Sunflower Pollution Control Division, this High Strength Discharge Permit (Permit) is granted to the above facility (i.e., Permittee) to discharge process wastewater to the City of Sunflower (City) Sanitary Sewer Collection System in accordance with the terms and conditions of this Permit.

The Permittee shall comply with Chapter 10 of the Sunflower City Code, all federal and state laws and regulations pertaining to the Permittee's discharge and all provisions of this Permit.

This Permit replaces all previously issued Permits. If you believe that the City should reconsider the conditions and limitations of this Permit you have the right to file a Petition for Review within twenty (20) days of your receipt of this Permit. A copy of Section 10-46.1 governing the Permit Appeals Process is attached.

Date of Issue: December 30, 2019	Chris Phatly
Modified on **January 13, 2019**	Water Quality Supervisor

I. SPECIFIC REQUIREMENTS

A. Discharge Limitations

1. The Permittee is authorized to discharge previously collected human wastes from portable toilets through a private manhole on their property, and truck/toilet washing/maintenance operation discharges to the compliance sampling point described as a **three inch Parshall flume vault located at the northwest corner of the property approximately 20 feet west of the driveway.**
2. The compliance sampling point is illustrated in Attachment A of this Permit.

2. Flow volume through the compliance sampling point averages 4,500 gallons per day but in no event shall exceed 7,000 gallons during any single day.

3. During the term of this Permit, all discharges shall comply with the general user requirements contained in Section 10-8 of the Sunflower City Code.

B. <u>Sampling Requirements and Procedures</u>

1. Permittee shall sample once per month (starting the month of January 2001) for arsenic, copper, lead, and mercury by the taking of a composite sample, and pH, total petroleum hydrocarbons (TPH) and total sulfides, by the taking of grab samples at the compliance sampling point. The pH shall be within the instantaneous limits of 5.0 - 10.5 s.u. (standard units). The TPH shall be 100 mg/l or less. There is no numerical limit at this time associated with the metals, or sulfide samples.

2. All samples shall be taken at the compliance sampling point specified in this Permit and, unless otherwise specified, before the wastewater joins or is diluted by any other wastestream, body of water or substance. All equipment used for sampling and analysis must be routinely calibrated and inspected and maintained to ensure accuracy. The sampling point shall not be changed without written approval of the City.

3. Sampling and analysis of these samples shall be performed in accordance with the techniques prescribed in 40 CFR Part 136, as may be amended. For TPH analysis, use EPA method 418.1.

4. If required, appropriate flow measurement devices shall be selected and used to ensure the accuracy and reliability of measurements of the volume of monitored discharges. Devices shall not be installed without prior written approval from the City.

C. <u>Periodic Monitoring Report Required</u>

1. All reporting (including written notifications, oral notifications and discharge sampling reports) required by this Permit shall, unless otherwise specified, be addressed to:

   City of Sunflower
   Water Services Department
   Pollution Control Division
   1534 West Montebello
   Sunflower, Arizona 85297

2. Each submitted discharge sampling report, written notification, or any other report required by this Permit, must be signed (see Part II. N of this Permit for signatory requirements).

3. Sampling results shall be summarized and reported on a High Strength Discharge Monitoring Report Form provided by the City. This report is due on the last day of each month and is to include all results of monitoring performed during that calendar month as well as information required for the prior calendar month that has not been previously submitted. The report must be received at the above address no later than the due date so as not to be considered late. The first report is due no later than January 31, 2001. Each report should indicate the results of all sampling as set forth in Part I (B) and (G) of this Permit. Reports must also be submitted during months in which no wastewater discharge occurred and include a zero discharge certification statement on a form provided by the City.

4. If Permittee samples more frequently at the compliance sampling point than required by this Permit, using test procedures approved under 40 CFR Part 136 or as specified in this Permit, the results of such sampling shall be reported in the monthly report.

D. pH Log Book

Permittee is required to maintain a log book of pH measurements showing date and time of measurement, name of the person performing the measurement, and pH meter calibration data for all samples collected at the compliance sampling location.

E. Maintenance of Compliance Monitoring Point

1. Permittee shall maintain the compliance sampling point, illustrated in Attachment A, in continuously efficient operations at all times.

2. Permittee is required to keep written documentation of maintenance which includes at least the following:

   a. Date of service;
   b. Who performed the service (contractor name or Permittee employee name and title);
   c. Nature of service (repaired - nature of repair, inspection, cleaned, etc.).

F. Maintenance of Pretreatment Interceptors

1. Permittee is required to maintain the two stage seven hundred fifty gallon sand/oil interceptor located approximately 6 feet west of the toilet cleaning pad and the three stage, two thousand gallon interceptor located 25 feet west of the northwest corner of the maintenance shop building which receives wastewater from the truck/toilet washing/maintenance operation in continuously efficient operations at all times.

2. Permittee is required to maintain written documentation of both of the interceptor's maintenance which includes at least the following:

   a. Date of service;

   b. Who performed the service (contractor name or Permittee name and title).

   c. Nature of service (pumped, repaired -- nature of repair, inspection, etc.)

G. <u>Access Restrictions/Security /Special Sampling Requirements</u>

1. Beginning February 1, 2001, permittee will perform screening tests on samples collected from individual trucks prior to discharge to the compliance sampling point, on a random basis picked by a computer system, for the following parameters and according to the following schedule:

   a. The following will be tested on every truck:

PARAMETER	ACCEPTABLE CRITERIA
PH	5.0 - 10.5 s.u.
ORP	-500 to +500 mv
Temperature	150° F or less

   b. From February 1, 2015 through July 31, 2001, a minimum of one truck per day will be tested for the following:

PARAMETER	**ACCEPTABLE CRITERIA**
Colorimetric analysis:	
Cyanide (filtered sample)	2.0 mg/L
Chromate (filtered sample)	0.5 mg/L
Copper (filtered sample)	10.0 mg/L
Test Paper:	
Lead	5.0 mg/L
Organic Solvent/Petroleum Hydrocarbons	10 mg/L gasoline
Oxidizer	3.0 mg/L as H_2O_2
Fluoride	20 mg/L
Iodine, Bromine, Chlorine	1 mg/L

   c. After the expiration of the time period in part b above, for the remaining term of this permit, a minimum of three trucks per week will be tested for those parameters identified in part b.

   d. In addition, a minimum of one sample every month will be collected from a truck and analyzed by a licensed laboratory for arsenic, copper, lead and mercury.

e. If any of the parameters identified above exceed the Acceptable Criteria, then the load will be temporarily stored in the 1,000 gallon above ground holding tank and handled as set forth in subparagraph 6 of this paragraph G.

f. The City anticipates that the sampling frequencies and Acceptable Criteria contained in this paragraph G may need to be changed based upon the sampling generated from February 1, 2010 through July 31, 2019, and in such event this Permit will be amended accordingly. However, until this Permit is amended, the sampling frequencies and Acceptable Criteria contained in this paragraph G will remain in effect.

Permittee will include all results of individual truck testing with monthly reports as required in Part I. C . of this Permit.

2. Prior to February 1, 2019, Permittee will purchase, install and maintain a locked manhole cover over the truck discharge point, with access being limited to a select number of Permittee's employees having keys.

3. Prior to March 1, 2019, Permittee will issue a form letter to all existing customers (and thereafter on an annual basis) and to each new customer at time of initial service, placing that customer on notice that any discharge of foreign material into portable toilets is prohibited.

4. Prior to March 1, 2019, Permittee will conspicuously label all portable toilets with a warning that any disposal of foreign substance into portable toilets is unlawful and may lead to fines and/or prosecution.

5. Permittee will provide all current service drivers and employees (prior to March 1, 2015) and future portable service drivers (within 15 days of hiring) with training to detect the presence of foreign material in the portable toilets. In addition to acknowledging the training provided by Permittee, all drivers will sign a separate Acknowledgement of Training Form stating their understanding of the following procedures:

a. All drivers will perform visual and olfactory inspections of each toilet for foreign material prior to and while pumping portable toilets;

b. In the event foreign material is detected during these inspections, the driver will notify Permittee's Facility Operations via mobile radio or telephone immediately;

c. The driver will tag the unit with a Bypass Ticket notifying the customer of the nature of the problem. The driver shall also attempt to contact a responsible party on the job site and advise that party to contact Permittee's office;

d. The driver will turn in the route card or route sheet with a copy of the Bypass Ticket to operations at the end of the route;

e. ACME Operations will then remove that unit from the route and forward the Bypass Ticket to the sales department for customer contact and resolution;

f. The ACME Sales Department will notify the customer of their responsibility to legally dispose of the foreign material. The customer will be advised to contact the ACME Sales Department when the foreign material has been removed;

g. Upon notification of removal by the customer, the sales department will notify ACME Operations. ACME Operations will conduct a field inspection of the unit and reinsert the unit into the route for service;

h. Any unit containing foreign material will not be removed from a particular job site until the customer has appropriately addressed the removal of the foreign material.

All signed Acknowledgement Training Forms will be placed in each employee's personnel file and be made available to City personnel during inspections. This employee training will be incorporated into Permittee's general monthly employee meetings, a record of which shall be maintained at the facility.

6. Prior to March 1, 2019, the Permittee will install and maintain a one thousand (1000) gallon above ground tank at the facility. If a questionable wastestream is determined while testing, that particular waste load will be temporarily stored in this tank. The contents will be retested by a licensed laboratory for a complete list of parameters as determined by the City. Should the retest confirm the wastestream is not suitable for discharge to the compliance point; the contents will be disposed of in a manner as required by state and federal law. At no time will Permittee discharge a questionable load to the sanitary sewer.

II. HIGH STRENGTH DISCHARGE PERMIT STANDARD CONDITIONS

A. Permittee Shall Provide Notice of Changes

Any changes, permanent or temporary, to the premises or operations that significantly change the quality or volume of the wastewater discharge or other changes that have occurred which differ from what was stated in the Permit application shall be reported by the Permittee 90 days prior to making the changes.

B. Permittee Shall Provide Notification of Noncompliance

Permittee shall notify the City within 24 hours of becoming aware of a discharge which is known or suspected to be in violation with any limitation or provision of this Permit, including an accidental spill of substances prohibited by Section 10 of the Sunflower City Code.

C. Permittee Shall Provide Information

The Permittee shall furnish to the Pollution Control Division, by the date requested, any information to determine whether cause exists for modifying or revoking this Permit, or to determine compliance with this Permit. The Permittee shall also furnish to the Pollution Control Division, upon request, copies of records required by this Permit to be kept by the Permittee.

D. Inspection and Entry of Facility

The Permittee shall provide free access to all areas of the facility to an authorized representative of the Pollution Control Division, upon the presentation of credentials and other documents as may be required by law, to:

1. Enter at any time during normal hours of operation upon the Permittee's premises where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this Permit;

2. Have access to and copy, at reasonable times, any records that must be kept under the conditions of this Permit;

3. Inspect at reasonable times any facilities, equipment (including monitoring and control equipment), practices, or operations regulated or required under this Permit and any production, or storage area where discharge regulated under this Permit, could originate or may be subject to regulation; and

4. Sample or monitor, for the purposes of assuring Permit compliance, any substances or parameters at any location.

E. Permittee Shall Retain Records

1. The Permittee shall retain on site, copies of all reports required by this Permit, including all emergency response procedures and incident documentation and

records of all data used to complete the application for this Permit, for a period of at least three years from the date of the document preparation.

2. All records which pertain to matters that are the subject of special orders or any other enforcement or litigation activities brought by the Pollution Control Division shall be retained and preserved by the Permittee until all enforcement activities have concluded and all periods of limitation with respect to any and all appeals have expired.

3. The Permittee shall retain records of all monitoring information, including all calibration and maintenance records and all original strip chart recordings for continuous monitoring instrumentation, for a period of at least three years from the date of the sample or measurement.

4. Sampling records shall contain the following:

    a. The date, exact place, time, and methods of sampling or measurements, and sample preservation techniques or procedures;

    b. Who performed the sampling or measurements;

    c. The date(s) analyses were performed;

    d. Who performed the analyses;

    e. The analytical techniques or methods used; and

    f. The results of such analyses.

5. Additional Sampling by the Permittee

    If the Permittee samples more frequently than required by this Permit, using approved test procedures or as specified in this Permit, the results of this monitoring shall be maintained as a part of Permittee's records for a period of at least three years from the date of the sampling.

F. <u>Emergency Response Procedures and Incident Documentation Reports</u>

1. Permittee shall have emergency response procedures which, at a minimum, identify how to document the incident(s) or other event(s) that does or may result in a discharge in excess of the Permit limitations to the sanitary sewer and identifies the agency(s) and official(s) to notify in case of a spill or need to discharge this process wastewater to the sanitary sewer.

2. Emergency incident documentation requirements shall at a minimum include:

    a. date, time of emergency
    b. description of emergency including discharge constituents and quantity
    c. documentation of agency and agency official notification
    d. cause of emergency

e. corrective actions taken or to be taken to correct the incident
f. corrective action plan to prevent a future incident
g. report on compliance with corrective action schedule(s)

3. Any emergency incident causing a wastewater discharge to the sanitary sewer does not relieve the Permittee from the requirements set forth in 40 CFR Part 403, Chapter 10 of the City Code and this Permit.

G. Duty to Reapply; Automatic Extension of Permit

If Permittee wishes to continue an activity regulated by this Permit after the expiration date of this Permit, Permittee must apply for and obtain a new Permit. The application must be submitted at least 60 calendar days before the expiration date of this Permit. Subject to the City's right to amend, or, revoke this Permit, or to deny a new Permit, this Permit shall automatically continue to remain in full force and effect after the expiration date if Permittee has timely filed the Permit application and a new Permit is not issued prior to the Permit expiration date.

H. Permit Modification

This Permit may be modified by the City:

1. To incorporate any new or revised federal, state, or local pretreatment standards or requirements;

2. To make changes due to material or substantial alterations or additions to the Permittee's operation which were not covered in the issued Permit;

3. To correct any errors;

4. To make changes that are deemed reasonably necessary to prevent pass through or interference, protect the quality of the water body receiving the treatment plant's effluent, protect worker health and safety, facilitate sludge management and disposal, protect against damage to the POTW and to ensure user compliance with Chapter 10 of the Sunflower City Code or state and federal laws, rules and regulation.

I. Permit Revocation

This Permit may be revoked for good cause, including but not limited to:

1. failure to notify the City of significant changes to the wastewater prior to the changed discharge;
2. failure to provide prior notification to the City of changed conditions pursuant to Section 10-44(f) of the Sunflower City Code;
3. misrepresentation or failure to fully disclose all relevant facts in the wastewater discharge Permit application;
4. falsifying self-monitoring reports;
5. tampering with monitoring equipment;
6. refusing to allow the City timely access to the facility premises and records;
7. failure to meet effluent limitations;
8. failure to pay fines and penalties;

9. failure to pay sewer charges;
10. failure to meet compliance schedules;
11. failure to complete a wastewater survey or the Permit application;
12. failure to provide advance notice of the transfer of business ownership of a Permitted facility; or
13. violation of any pretreatment standard or requirement, or any terms of the Permit or requirement of Chapter 10 of the Sunflower City Code; or
14. when the City has determined that a Permit reclassification is required.

J. Permit Not a Property Right

The issuance of this Permit does not convey any property rights of any sort, or any exclusive privileges, nor does it authorize any injury to private property or any invasion of personal rights, nor any infringement of federal, state or local laws or regulations.

K. Non-Transferability of Permit

This Permit is not transferable to any person. In the event of sale or change of ownership the Permittee shall provide written notice to the Pollution Control Division thirty (30) days prior to the effective date of sale or change of ownership.

L. Severability

The provisions of this Permit are severable. If any provision of this Permit, or the application of any provision of this Permit to any circumstances is held invalid, the application of such provision to other circumstances, and the remainder of this Permit, shall not be affected thereby.

M. Civil and Criminal Penalties

Any violation of this Permit can result in both civil and criminal penalties that are in addition to all remedies available to the City set forth in Chapter 10 of the Sunflower City Code. Civil Penalties can be $25,000 per day per violation. Criminal misdemeanors can result in fines of $2500.00 per day per violation in addition to imprisonment of 6 months.

N. Signatory Requirements

Permit applications, correspondence and all reports shall be signed by the appropriate signatory:

1. For a corporation: by a corporate officer or other persons performing a similar policy or decision-making function for the corporation;

2. For a partnership or sole proprietorship: by a general partner or the proprietor, respectively;

3. All applications, correspondence, reports, and self-monitoring reports may be signed by a duly authorized representative of the person described above. A person is a duly authorized representative only if:

   a. the authorization is made in writing by a person described above; and

b. the authorization specified either an individual or a position having responsibility for the overall operation of the regulated facility or activity, such as the position of plant manager, superintendent, or position of equivalent responsibility. (A duly authorized representative may thus be either a named individual or any individual occupying a named position).

4. Any person signing a document required under this Permit shall make the following certification:

"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."

Topic 5 - Permitting Considerations Section Post Quiz

1. The permit writer should also avoid long and confusing requirements. However, the permit writer should not be so brief as to leave out vital specifics. A permit frequently acts as the principal notification to the Industrial User of its responsibilities for compliance. Therefore, permit requirements must be clear and simple to understand. True or False

Common Permitting Errors and Omissions
The permit writer should keep in mind that any of the following errors and omissions in the permit might cause it to be susceptible to legal challenge, to fail to properly regulate the Industrial User, or to be misleading or confusing to the permittee:

2. Failure to correctly calculate and apply effluent limitations from applicable Pretreatment Standards. True or False

3. Failure to apply the least stringent limit (federal categorical Pretreatment Standard, state requirement, or local limit). True or False

4. Realization to specify adequate monitoring or analytical requirements, including a failure to identify specific monitoring locations. True or False

5. Failure to incorporate specific citations to requirements contained in an ordinance or regulation, where the requirements are not otherwise set forth in the permit. True or False

6. Realization to specify the signatory requirements for self-monitoring reports and other notification requirements. True or False

7. Failure to account for any known seasonal changes or other predictable variations in the effluent. True or False

Flexibility
8. Specific conditions within each permit element should be tailored to the Industrial User for which the permit is intended. While it might be obvious that very dissimilar Industrial Users will need different permit conditions, even similar Industrial Users could need permit conditions tailored to site-specific discharge situations. True or False

9. Certain permit conditions are flexible and can be modified. For example, the permit writer cannot modify categorical Pretreatment Standards and Requirements or the general and specific prohibitions in 40 CFR 403.5. True or False

The following are federal requirements that must be imposed on Industrial Users where they apply:
10. Those conditions based on federal Pretreatment Standards and Requirements, including any BMP requirements. True or False

11. Use of the CWF or flow-weighted averaging formula to derive appropriate limits for CIUs where applicable. True or False

12. Suggestion to follow analytical methods in 40 CFR Part 136 or other EPA-approved methods for wastewater analyses. True or False
13. Flexibility is never provided, however, in the drafting process, never allowing the permit writer to analyze comments and modify portions of the permit. True or False

Situations (depending on legal authority) that could result in modified permit conditions include the following:
14. Wastewater flow rate [Note: Modifications to the wastewater flow rate may exceed the flow used in the development of the approved maximum allowable industrial loading.
True or False

In addition, if an Industrial User is classified as an MTCIU, its flow rate modification must not exceed the following:
15. 0.01 percent of the design dry-weather hydraulic capacity of the POTW, or 5,000 gpd, whichever is smaller. True or False

16. 0.01 percent of the design dry-weather organic capacity1 of the POTW. True or False

17. 0.01 percent of the minimum allowable headworks loading (MAHL) for any pollutant regulated by the applicable categorical Pretreatment Standard for which approved local limits were developed by the POTW in accordance with 40 CFR 403.5(c).] True or False

Documenting Permit Decisions
18. Throughout the permit drafting process, the permit writer should copy from other Cities' ordinance documents for several reasons. First, it will help the permit writer develop the permit thoroughly and logically. True or False

19. Second, it will facilitate defending any challenges that the permit terms and conditions were developed arbitrarily or capriciously. True or False

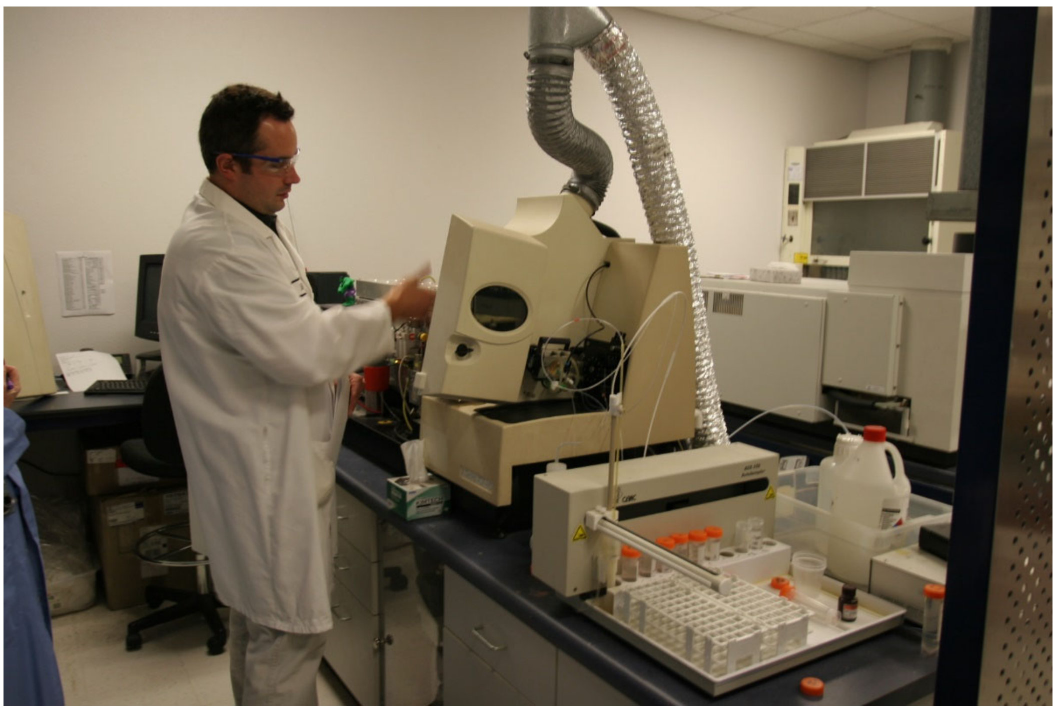
20. Third, it will provide the required documentation in the permit record of any relief from otherwise applicable requirements (i.e., pollutants not expected to be present, equivalent limits, decisions on general control mechanisms, decisions on NSCIU classification, and decisions on reduced monitoring requirements). True or False

Topic 6 - Effluent Limitations Section

Topic 6 - Section Focus: You will learn the basics of CWA/POTW/pretreatment program's effluent limitations, priority pollutants and Local Limit sampling. At the end of this section, you will be able to understand and describe Clean Water Act's rule concerning effluent limitations and prohibited discharges. The student will be able to select which pollutants to specifically regulate and how to establish permit effluent limits. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 6 – Scope/Background: The purpose of the pretreatment program is to block the introduction of pollutants, which can cause damage to equipment and interference with the wastewater treatment process, into the wastewater collection and transmission system. The permit writer must decide which of the pollutants require regulation. The permit must contain effluent limits that are based on the following:

- Categorical Pretreatment Standards [40 CFR Parts 405–471]
- National prohibited discharges (general and specific) [40 CFR 403.5(a) and (b)]
- Local limits [40 CFR 403.5(c) and (d)]



6.1 Selecting Pollutants to be Regulated

To identify pollutants to be regulated, the permit writer must first determine whether the Industrial User is subject to categorical Pretreatment Standards. Next, the permit writer should determine what pollutants are present or suspected of being present in the wastewater. Then a determination can be made as to which of the pollutants to regulate. Those three steps are outlined below. Of course, specific permit limits must be included in the permit for pollutants regulated by applicable federal categorical Pretreatment Standards.

6.1.1 Which Pollutants Require Regulation?

The permit writer must decide which of the pollutants require regulation. The permit must contain effluent limits that are based on the following:

- Categorical Pretreatment Standards [40 CFR Parts 405–471]
- National prohibited discharges (general and specific) [40 CFR 403.5(a) and (b)]
- Local limits [40 CFR 403.5(c) and (d)]
- Other site-specific limits needed to protect the POTW, receiving water, and worker health and safety

The examples in Table 6-1 illustrate how a permit writer selects pollutants for regulation.

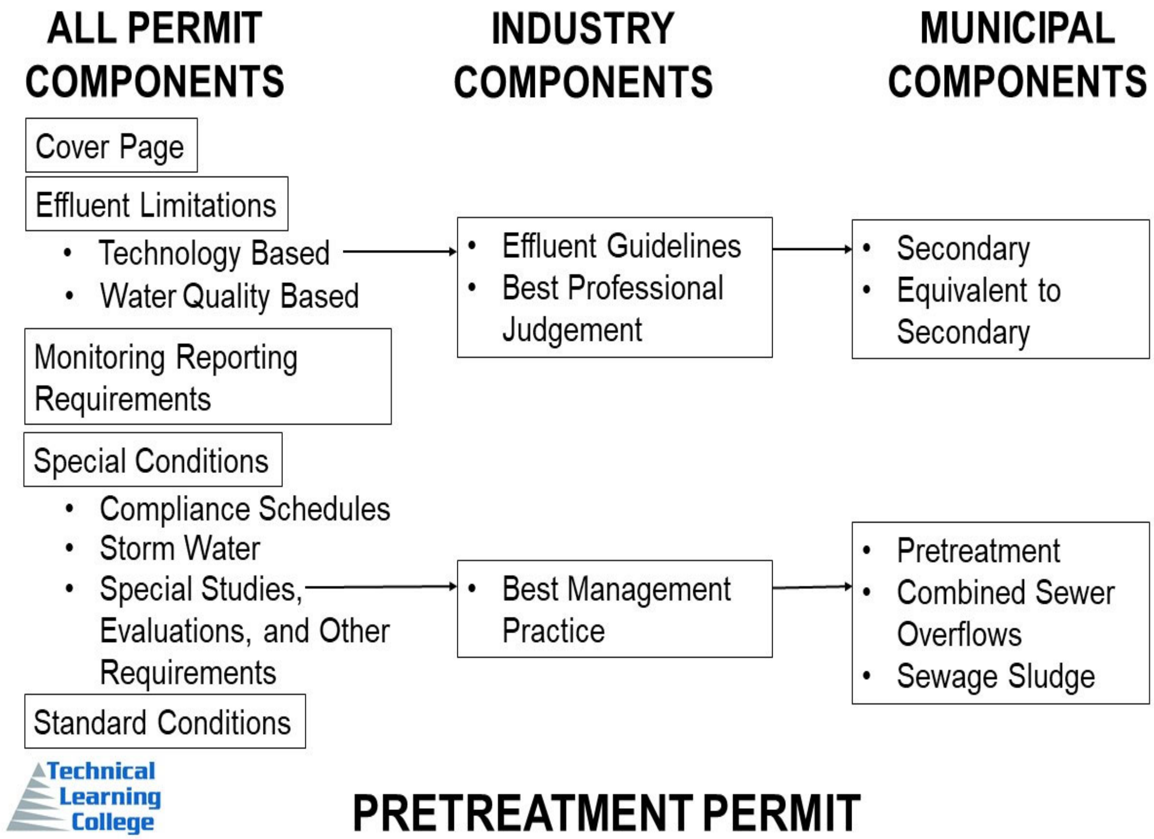


TABLE 6-1
EXAMPLES OF SELECTING POLLUTANTS FOR REGULATION
EXAMPLE 1. SELECTING POLLUTANTS ON THE BASIS OF CATEGORICAL PRETREATMENT STANDARDS

The permit writer at the Cleanwater POTW receives a permit application from the Batteries R Us Company. The permit writer notices that the user indicated that it was not subject to any categorical pretreatment standards, but the application indicates that the company produces zinc anode batteries on-site. The application also indicates that the facility manufactures its own zinc oxide anodes and silver oxide cathodes. Furthermore, the permit writer notes that the facility's wastewater discharge includes process wastewater from the anode and cathode manufacturing processes, floor and equipment washdown, and employee showers. Even though the Batteries R Us application indicates that it was not subject to any categorical pretreatment standards, the permit writer reviewed a summary list of categorical standards (See Appendix G – Summary of Industrial Sectors with Categorical Pretreatment Standards and Requirements) and realized that EPA has established categorical pretreatment standards for battery manufacturers [40 CFR Part 461]. The permit writer will consult those regulations to determine which subpart of 40 CFR Part 461 applies to the discharger and will incorporate the appropriate categorical effluent limits in the discharger's permit.

EXAMPLE 2. SELECTING CONVENTIONAL POLLUTANTS FOR REGULATION
The operator at the Cleanwater POTW noticed that periodically the influent to his plant was milky white. He collected an influent sample and noted that the milky color was due to very fine particles in the waste that did not settle readily but produced a high TSS value. As a result, the plant violated its NPDES TSS limit. The operator traced the milky white discharge to ABC Company. After reviewing data indicating extremely high TSS concentrations from ABC Company's discharge, the permit writer included a TSS limit in the ABC Company's permit to reduce the TSS load to the POTW and thus prevent pass through.

EXAMPLE 3. SELECTING TOXIC ORGANIC POLLUTANTS FOR REGULATION
In reviewing the discharge data for the Double D Company, the permit writer noticed that the discharge contained 106 mg/L of 2,4,6-trichlorophenol and 5.3 mg/L of pentachlorophenol. The permit writer was faced with a problem. The POTW's NPDES permit does not contain limits for such pollutants, and no data are available on the levels of the pollutants in the POTW's effluent, influent, or sludge. Because the permit writer did not know the concentrations of either pollutant at the treatment plant, he decided to have the POTW analyze its influent, effluent, and sludge for the organic priority pollutants.

The resulting data indicated concentrations of 0.580 mg/L and 0.060 mg/L of 2,4,6-trichlorophenol and pentachlorophenol, respectively, in the treatment plant's influent. Sludge and effluent data indicated the presence of both pollutants, with pentachlorophenol present in the effluent at levels exceeding state ambient water quality criteria. Because of concern for the water quality of the receiving stream and because of broad authority in the local ordinance for the POTW to regulate Industrial Users so as to prevent harm to the environment, the permit writer established local limits for both compounds and included the requirements in the Double D Company's permit.

EXAMPLE 4. SELECTING POLLUTANTS ON THE BASIS OF POTENTIAL HEALTH RISKS

The Anytown POTW superintendent had not noticed any apparent inhibition of his treatment system, but plant operators complained periodically about strong organic smells in the wet well and at Triple T Company's sampling manhole. In reviewing the discharge data from the Triple T Company, he noticed that the company discharged 1,2 dichloroethane.

Additional sampling of the gases in the collection system revealed concentrations of 1,2 dichloroethane that exceeded the Occupational Safety and Health Administration's Immediately Dangerous to Life and Health (IDLH) levels. Because of the broad authority in the local ordinance for the POTW to regulate Industrial Users so as to ensure the health and safety of the workers at the POTW, the superintendent decided to establish a local limit for 1, 2 dichloroethane and add it to the Triple T Company's permit.

6.1.1.1 Categorical Pretreatment Standards

Categorical Pretreatment Standards are technology-based standards for a selected group of industries established by EPA under authority of the CWA. These standards are developed on the basis of industry-wide studies of current treatment practices for pollution control (e.g., treatment technology) and, therefore, establish national baseline pollution control requirements for the regulated industrial categories. Pretreatment Standards are generally promulgated for both existing sources and new sources. These standards could be the same or different. If an Industrial User is subject to categorical Pretreatment Standards, the permit writer must include effluent limits based on these standards in the user's permit.

In certain situations, the Control Authority may have the option to authorize a CIU to forgo sampling for a pollutant not expected to be present [40 CFR 403.12(e)(2)]. Before implementing that option, the Control Authority must have the legal authority to implement the provision (i.e., the state and local regulations include the provision and it has been submitted to and approved by the Approval Authority in accordance with 40 CFR Part 403). If the Control Authority has determined that a monitoring waiver is appropriate, the permit must still contain the applicable effluent limitations for the pollutants with waived monitoring requirements.

Furthermore, any grant of a monitoring waiver by the Control Authority must be included as a condition in the user's permit along with the requirements to submit the certification statement outlined at 40 CFR 403.12(e)(2)(v) with each user self-monitoring report. In addition, the permit must include the notification requirement that if a pollutant with waived monitoring requirements is found to be present or is expected to be present according to changes that occur in the user's operations, the user must immediately notify the Control Authority and comply with the monitoring requirements of 40 CFR 403.12(e)(1). To include all relevant categorical Pretreatment Standards in the permit, the permit writer must be familiar with specific categorical Pretreatment Standards to which the Industrial User is subject and follow the rules below to apply categorical Pretreatment Standards.

Rules for Applying Categorical Pretreatment Standards

- Determine the proper category and subcategory for the industrial processes operated by the permittee.
- Identify all regulated, unregulated, and dilution wastestreams.
- Identify appropriate sampling locations.

Categorical standards apply directly to specific wastestream or at the end of treatment of that wastestream. When the designated sampling location described in the permit contains a categorically-regulated wastestream and one or more other wastestreams not regulated by the same categorical standard, an alternative categorical limit must be calculated.

- If effluent limits have both the daily maximum and the monthly average categorical Pretreatment Standards, both limits must be included in the permit.
- Limitations on *all* pollutants regulated by the categorical Pretreatment Standards must be included in the permit. Note, however, that some of the categorical regulations allow the use of indicator pollutants (e.g., oil and grease monitoring in lieu of TTO monitoring for dischargers subject to 40 CFR Part 467, Aluminum Forming) or allow exemptions from monitoring for certain pollutants (usually requiring periodic certification of non-use).
- Any grant of a monitoring waiver by the Control Authority must be included in the Industrial User's control mechanism.
- Upon approval of a monitoring waiver, the Industrial User's control mechanism must include the requirement for the user to submit the certification statement at 40 CFR 403.12(e)(2)(v).

• The Control Authority has the option of converting production-based categorical Pretreatment Standards to equivalent mass or equivalent concentration limits.
• The Control Authority has the option of converting categorical Pretreatment Standards that are expressed in terms of concentration to equivalent mass limits. [Note: This provision must be incorporated into the pretreatment program in accordance with 40 CFR Part 403 before implementation.]
• The Control Authority has the option of converting flow-based mass limits for facilities in the Organic Chemicals, Plastics, and Synthetic Fibers [40 CFR Part 414], Petroleum Refining [40 CFR Part 419], and Pesticide Chemicals [40 CFR Part 455] categories to concentration-based limits. [Note: This provision must be incorporated into the pretreatment program in accordance with 40 CFR Part 403 before implementation.]
• Categorical Pretreatment Standards establish the compliance date(s) by which Industrial Users covered by the standards must be in compliance. The Control Authority cannot extend these federally promulgated dates in the permit.

Several EPA documents provide guidance on how to apply categorical Pretreatment Standards. The guidance documents should be used to supplement the information provided in this section and in the Standards themselves for incorporating categorical effluent limits into permits that are based on the standards.

Rules for Production-Based Categorical Pretreatment Standards

Incorporating production-based categorical Pretreatment Standards in permits involves special considerations. The standards are expressed in terms of an allowable pollutant mass discharge per unit of production, such as pounds of pollutant per 1,000 pounds of product produced. The standards can be placed in the permit verbatim from the regulations. The permit should then require the Industrial User to submit actual production data from the date(s) on which the compliance samples were collected and to calculate the actual mass of pollutant(s) discharged, on the basis of flow and concentration, to evaluate compliance for that specific day.

Often, it might be impractical or difficult for the Control Authority to independently determine or verify compliance because the production rate and the wastestream flow and pollutant concentration must be known. The Control Authority has the option of using equivalent mass or concentration limits [40 CFR 403.6(c)]. Such limits use an industry's long-term average daily production and flow rates to derive the corresponding daily maximum and monthly average limits.

The Industrial User permit may function as the legal document for the conversion of production-based standards to equivalent mass or concentration limits. These equivalent limits are deemed Pretreatment Standards under section 307(b) of the CWA and are federally enforceable. It is critical when converting production-based standards to equivalent mass or concentration limits that the permit writer correctly calculate the equivalent limits and document the calculations.

(Equivalent Mass Limits (in pounds per day [lbs/day])

$$\frac{\text{Pounds of allowable pollutant loading (Categorical Standard)}}{\text{Per day for each 1,000 pounds of product produced}} \times \left(\text{Long-term average daily production rate in 1,000 pound increments}\right)$$

(Equivalent Mass Limits (in pounds per day [lbs/day])

$$\frac{\left(\dfrac{\text{Pounds of allowable pollutant loading (Categorical Standard)}}{\text{Per day for each 1,000 pounds of product produced}} \times \left(\text{Long-term average daily production rate in 1,000 pound increments}\right)\right)}{(8.34 \times \text{Long-term average process effluent flow (mgd)})}$$

(Note: 8.34 is the number conversion for pounds per gallon [lbs/gal])

A Permit Containing Equivalent Limits Must Clearly Specify:

(1) the applicable equivalent limits;
(2) the flow and production rates upon which the limits are based;
(3) the requirement that the Industrial User report a reasonable measure of its long-term production rate in each periodic compliance report;
(4) the requirement that the Industrial User notify the Control Authority of significant changes in long-term flow and production rates within 2 days of knowing that they will change in the next calendar month; and
(5) a provision that the Control Authority may modify the permit on the basis of such new information

Determining the appropriate production rate is one of the critical factors in deriving equivalent limits. EPA recommends using a production figure that approximates the long-term average. Data for a day, week, month, or year that are unusually high or low should not be used; 3 to 5 years of data should be reviewed to determine the appropriate long-term average.

For example, after reviewing 5 years of data, the permit writer could select the highest yearly average (provided that this value does not vary by more than 20 percent to the most recent annual average). If a production rate varies greater than 20 percent, the Control Authority should contact the facility and determine the basis for the variation. If a facility does not have good historical data, as in the case of a new facility or a facility that has had significant operational changes, the permit writer will have to rely on the facility's future projections for production.

Detailed guidance and procedures for developing and applying equivalent limits and example problems are presented in EPA's *Guidance Manual for the Use of Production-Based Pretreatment Standards and the Combined Wastestream Formula*. EPA encourages the permit writer to use that guidance manual when developing equivalent limits.

If an Industrial User is expected to have significant fluctuations in the production (e.g., a 20 percent increase or decrease in the long-term average) during the permit period, a tiered permit could be considered. For more detailed discussion on tiered permits, see Section 6.2.6.

Rules for Applying Equivalent Mass Limits for Concentration Limits

Before establishing equivalent mass limits, the Control Authority must have the legal authority to implement such a provision (i.e., the state and local regulations include the provision and it has been submitted to and approved by the Approval Authority in accordance with 40 CFR Part 403).

Where a program has been modified to do so, the Control Authority has the option of establishing equivalent mass limits for concentration limits [40 CFR 403.6(c)(5)]. For an Industrial User to be eligible for equivalent mass limits, the user must do the following:

- Employ or demonstrate that it will employ water conservation methods and technologies that substantially reduce water use during the term of its permit.
- Currently use control and treatment technologies adequate to achieve compliance with the applicable categorical Pretreatment Standards and not have used dilution as a substitute for treatment.
- Provide sufficient information to establish the facility's actual average daily flow rate for all wastestreams, on the basis of data from a continuous effluent flow monitoring device, as well as the facility's long-term average production rate. Both the actual average daily flow rate and long-term production rate must be representative of current operation conditions.
- Not have daily flow rates, production levels, or pollutant levels that vary so significantly that equivalent mass limits are not appropriate to control the discharge.
- Have consistently complied with all applicable categorical Pretreatment Standards during the period before the user's request for equivalent mass limits.

In addition, the following provisions must be included in a permit issued to an Industrial User subject to equivalent mass limits:

- Maintain and effectively operate control and treatment technologies adequate to achieve compliance with the equivalent mass limits.
- Continue to record the facility's flow rates through the use of a continuous effluent flow-monitoring device.
- Continue to record the facility's production rates and notify the Control Authority whenever production rates are expected to vary by more than 20 percent from its baseline production rates.
- Continue to employ the same or comparable water-conservation methods and technologies as those implemented to qualify for the equivalent mass limits.

If the Control Authority chooses to establish equivalent mass limits, it may retain the same equivalent mass limit in subsequent permit terms if the user's actual average daily flow rate was reduced solely as a result of implementing water-conservation methods and the actual average daily flow rate used in the original calculation of the equivalent mass limit was not based on the use of dilution as a substitute for treatment. In addition, the Control Authority must do the following:

- Calculate the equivalent mass limits by multiplying the actual daily flow rate of the regulated process(es) of the user by the concentration-based categorical Pretreatment Standards and the appropriate conversion factors.
- Reassess the equivalent mass limit and recalculate the limit as necessary to reflect changed conditions at the facility.

Rules for Applying Pollutant Not Expected to be Present

Before authorizing an Industrial User to forgo sampling of a pollutant not present, the Control Authority must ensure that it has the legal authority to implement such a provision (i.e., the state and local regulations include the provision and it has been submitted to and approved by the Approval Authority in accordance with 40 CFR Part 403). Where the program has included this provision, the Control Authority has the option to authorize a CIU to forgo sampling of a pollutant if the user can demonstrate through sampling and a technical evaluation of the facility's operations, that a given pollutant is neither present nor expected to be present in the discharge, or is present only at background levels [40 CFR 403.12(e)(2)]. This provision, however, does not supersede the certification processes and requirements established in categorical Pretreatment Standards, except as specified in the categorical Pretreatment Standard (e.g., TTO certification for metal finishing, 40 CFR Part 433).

Such an authorization is subject to the following conditions:

- The Control Authority may authorize a waiver where a pollutant is determined to be present solely because of sanitary wastewater discharged from the facility, provided that the sanitary wastewater is not regulated by an applicable categorical Pretreatment Standard and includes no process wastewater.
- The monitoring waiver is valid only for the duration of the effective period of the permit but in no case longer than 5 years. The user must submit a new request for the waiver before the waiver may be granted for each subsequent permit.

In making a demonstration that a pollutant is not present, the user must provide data from at least one sampling of the facility's process wastewater before any treatment present at the facility that is representative of all wastewater from all processes.

- The request of a monitoring waiver must be signed in accordance with 40 CFR 403.12(l) and include the certification statement in 40 CFR 403.6(a)(2)(ii).
- Nondetectable sample results may be used only as a demonstration that a pollutant is not present if the EPA-approved method from 40 CFR Part 136 with the lowest minimum detection level for that pollutant is used in the analysis.
- Any grant of the monitoring waiver by the Control Authority must be included as a condition in the user's permit. The reasons supporting the waiver and any information submitted by the user in its request for the waiver must be maintained by the Control Authority for at least 3 years after the expiration of the waiver. In addition, the following provisions must be included as permit provisions.
  - Upon approval of the monitoring waiver, the user must certify on each report with the statement below, that there has been no increase in the pollutant in its wastestream because of activities of the user:

    On the basis of my inquiry of the person or persons directly responsible for managing compliance with the Pretreatment Standard for 40 CFR _________ [specify applicable national Pretreatment Standard part(s)], I certify that, to the best of my knowledge and belief, there has been no increase in the level of _________ [list pollutant(s)] in the wastewaters because of the activities at the facility since filing the last periodic report under 40 CFR 403.12(e)(1).
  - If a waived pollutant is found to be present or is expected to be present on the basis of changes that occur in the user's operation, the user must immediately comply with the monitoring requirements of 40 CFR 403.12(e)(1) or other, more frequent monitoring requirements imposed by the Control Authority and notify the Control Authority.

6.1.1.2 National Prohibited Discharges

Section 403.5(a) and (b) of the General Pretreatment Regulations establishes general and specific prohibitions that apply to all nondomestic users that discharge to POTWs (see Table 7-4). Local ordinances for POTWs with approved pretreatment programs must include the authority for local enforcement of those provisions. The permit writer should keep informed of developments in this area to ensure that all permits accurately incorporate all federal pretreatment requirements.

TABLE 6-4 National Prohibited Discharges General Prohibitions

A user may not introduce into a POTW any pollutants that cause pass through or interference [40 CFR 403.5(a)(1)].

Specific Prohibitions:

The following pollutants must not be introduced into a POTW:

- Pollutants that create a fire or explosion hazard in the POTW, including, but not limited to, wastestreams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 262.21 [40 CFR 403.5(b)(l)]

- Pollutants that will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, unless the POTW is specifically designed to accommodate such discharges [40 CFR 403.5 (b) (2)]

- Solid or viscous pollutants in amounts that will cause obstruction to the flow in the POTW resulting in interference [40 CFR 403.5(b)(3)]

- Any pollutant, including oxygen demanding pollutants (BOD, and the like) released in a discharge at a flow rate or pollutant concentration that will cause interference with the POTW [40 CFR 403.5(b)(4)]

- Heat in amounts that will inhibit biological activity in the POTW resulting in interference, but in no case heat in such quantities that the temperature at the POTW exceeds 40 degrees Centigrade (104 degrees Fahrenheit) unless the Approval Authority, upon request of the POTW, approves alternate temperature limits [40 CFR 403.5(b)(5)]

- Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil in amounts that will cause interference or pass through [40 CFR 403.5(b)(6)]

- Pollutants that result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity that could cause acute worker health and safety problems [40 CFR 403.5(b)(7)]

- Any trucked or hauled pollutants, except at discharge points designated by the POTW. [40 CFR 403.5(b)(8)]

TABLE 6-5 EXAMPLE OF INCORPORATING PROHIBITED DISCHARGES IN PERMIT VERBATIM IN STANDARD CONDITIONS SECTION OF PERMIT

Part IV—STANDARD CONDITIONS

1. The permittee must comply with all the general prohibited discharge standards in Section 5 of the city ordinance. Namely, the Industrial User must not discharge wastewater to the sewer system:

a) Wastewater having a temperature greater than [______ degrees F (_______ degrees C)], or that will inhibit biological activity in the treatment plant resulting in Interference, but in no case wastewater that causes the temperature at the introduction into the treatment plant to exceed 104 degrees F (40 degrees C);

b) Fats, oils, or greases of animal or vegetable origin in concentrations greater than [______] mg/L;

c) Pollutants that create a fire or explosion hazard in the POTW, including wastestreams with a closed cup flashpoint of less than one hundred forty (140) degrees Fahrenheit (60 degrees C) using the test methods specified in 40 CFR 261.21;

d) Wastewater causing two readings on an explosion hazard meter at the point of discharge into the POTW, or at any point in the POTW, of more than [______ percent (______)%] or any single reading over [_______percent (_____)%] of the Lower Explosive Limit of the meter.

e) Solid or viscous substances in amounts that will cause obstruction of the flow in the POTW resulting in Interference [but in no case solids greater than ____inch(es) (____") or _______ centimeter(s) (____cm) in any dimension];

f) Petroleum oil, nonbiodegradable cutting oil, or products of mineral oil origin, in amounts that will cause interference or pass through;

g) Having a pH lower than 5.0 or higher than [____], or otherwise causing corrosive structural damage to the POTW or equipment;

h) Pollutants that result in the presence of toxic gases, vapors, or fumes within the POTW in a quantity that could cause acute worker health and safety problems;

i) Noxious or malodorous liquids, gases, solids, or other wastewater that, either singly or by interaction with other wastes, are sufficient to create a public nuisance or hazard to life, or to prevent entry into the sewers for maintenance or repair;
j) Sludges, screenings, or other residues from the treatment of industrial wastes;

k) Containing any substance that could affect the treatment plant's effluent and cause violation of the NPDES permit requirements;

l) Containing any substance that would cause the treatment plant to be in noncompliance with sludge use, recycle or disposal criteria pursuant to guidelines or regulations developed under section 405 of the Clean Water Act, the Solid Waste Disposal Act, the Clean Air Act, the Toxic Substances Control Act or other regulations or criteria for sludge management and disposal as required by the state;

m) Wastewater that imparts color, which cannot be removed by the treatment process, such as, but not limited to, dye wastes and vegetable tanning solutions, which consequently imparts color to the treatment plant's effluent, thereby violating [the name of the POTW's] NPDES permit;

n) Medical wastes, expect as specifically authorized by the [the Superintendent] in a permit;

o) Stormwater, surface water, ground water, artesian well water, roof runoff, subsurface drainage, swimming pool drainage, condensate, deionized water, noncontact cooling water, and unpolluted wastewater, unless specifically authorized by [the Superintendent];

p) Wastewater causing, alone or in conjunction with other sources, the treatment plant's effluent to fail toxicity tests;

q) Detergents, surface-active agents, or other substances that that might cause excessive foaming in the POTW;

r) Wastewater containing any radioactive wastes or isotopes except in compliance with applicable state or federal regulations; or

s) Pollutants, including oxygen-demanding pollutants (BOD, and the like) released in a discharge at a flow rate or pollutant concentration, which, either singly or by interaction with other pollutants, will cause Interference with the POTW.

6.1.2.3 Local Limits

Section 403.5(c) of the General Pretreatment Regulations requires Control Authorities to develop and enforce specific limits to implement the general prohibition against pass through and interference [40 CFR 403.5(a)] and the specific prohibitions [40 CFR 403.5(b)]. In July 2004, EPA published an extensive guidance document on developing and implementing local limits (*Local Limits Development Guidance*). For the purposes of this guidance manual, it is assumed that the Control Authority has developed local limits in accordance with that guidance or some other acceptable approach.

The Control Authority might have established local limits for any number of pollutants. The two main considerations on how to incorporate such local limits into Industrial User permits are whether the sewer use ordinance contains all the local limits and how the Control Authority has allocated its maximum allowable industrial loading to its Industrial Users.

The Control Authority must have the legal authority to implement its approved local limits. The permit must include a list of all applicable local limits even if the Control Authority is not requiring the Industrial User to monitor for all or any of the pollutants with local limits. This approach ensures that the Industrial User is aware of all local limits. The permit must also include monitoring requirements as specified by 40 CFR 403.12 for all the pollutants of concern.

The permit writer can establish monitoring requirements for the pollutants present in the discharge. However, the monitoring frequency for pollutants known to be absent, or present at levels at or below local background concentrations, could be reduced.

The Control Authority may develop industry-specific local limits. Because each permitted industry receives different numerical limits, it is difficult to incorporate them into a local sewer use ordinance. In such a situation, the sewer use ordinance will generally establish the authority to develop and implement local limits and state that the limits will be enforced through Industrial User permits. All local limits applicable to the Industrial User must be included in its permit. This is particularly important because the limits are not incorporated in the ordinance. The monitoring frequency for any pollutant of concern could then be set on the basis of the pollutant's presence in the wastestream.

Establishing or revising local limits is considered to be a modification of the POTW's pretreatment program. Therefore, the Control Authority must submit to the Approval Authority for its review and approval any new or changed local limits. The POTW must submit a notice to the Approval Authority that states the basis for the modification and must provide a modified program description and other documentation requested by the Approval Authority.

Modifications that relax local limits, except for the modifications to local limits for pH and reallocations of the Maximum Allowable Industrial Loading of a pollutant that do not increase the total industrial loadings for the pollutant, are considered to be substantial program modifications. Approval procedures for modifications of local limits are described in 40 CFR 403.18. After the Approval Authority approves a modification, the Control Authority shall incorporate it into the POTW's NPDES permit [40 CFR 403.18 and 40 CFR 122.62].

6.1.2.4 Best Management Practices

BMPs are management and operational procedures that are intended to prevent pollutants from entering a facility's wastestream or from reaching a discharge point. BMPs are defined as schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to implement the general and specific prohibitions listed at 40 CFR 403.5(a)(1) and (b). BMPs also include treatment requirements; operating procedures; and practices to control plant site runoff, spillage, or leaks; sludge or waste disposal; or drainage from raw materials storage. There are two different circumstances in which BMPs may be Pretreatment Standards.

The first is when a POTW establishes BMPs as local limits or in addition to the local limits to implement the general and specific prohibitions. The second is when the BMPs are categorical Pretreatment Standards established by EPA. The Control Authority should use BMPs instead of numeric limits where determining compliance with numeric limits is infeasible or as a supplement to numeric limits as appropriate to meet the requirements of the CWA.

Before implementing BMPs as a supplement to local limits, the Control Authority must ensure that it has the legal authority to implement such a provision (i.e., the state and local regulations include the provision and it has been submitted to and approved by the Approval Authority in accordance with 40 CFR Part 403).

Where the program has been approved to do so, the Control Authority has the option to use BMPs in lieu of numeric limits. BMPs required, however, by a categorical Pretreatment Standard are not optional and must be included in CIU permits [40 CFR 403.8(f)(1)(iii)(B)(3)]. As such, the CIU permits must include applicable BMPs as required by categorical Pretreatment Standards. For example, facilities may develop toxic organic management plans in lieu of sampling to demonstrate compliance with the TTO limit at 40 CFR Part 433 (Metal Finishing category).

If the Control Authority has been approved to use BMPs in lieu of or in addition to numeric limits, the BMPs should include the following:

- *Specific notice to Industrial Users of requirements and enforceability*. Such a notice, provided through POTW sewer use ordinances or individual or general control mechanisms, should make clear which users are subject to BMPs, and what affected users must do to comply with their requirements.
- *Installation of treatment*. POTWs should provide criteria or specifications that the equipment must satisfy. For example, a requirement for use of oil/water separators at auto repair facilities could include sizing and design criteria. EPA cautions POTWs to avoid endorsing the use of specific brands or vendors.
- *Requirements for or prohibition on certain practices, activities, or discharges*. POTWs should include specific requirements or prohibitions where necessary to ensure that the use of such BMPs is protective. An example would be a prohibition on discharges of tetrachloroethene from dry cleaning facilities.
- *Requirements for O&M of treatment units*. POTWs should spell out their operations and maintenance (O&M) expectations to ensure that treatment systems continue to perform as designed and installed. For example, restaurants could be required to have grease interceptors cleaned out at a specified frequency.
- *Time frames associated with key activities*. POTWs should provide time frames for when management practices must be implemented or when required treatment must be installed and fully operational. Other milestones should be added to the schedule where necessary to facilitate the oversight of BMP implementation.

• *Compliance certification, reporting and records retention*. Establishing specific procedures for such requirements will enable POTWs to verify whether required equipment has been installed or whether required maintenance has been performed at the specified frequency.

• *Provision for reopening or revoking the BMP conditions*. As with numeric limits, POTWs should include language in the sewer use ordinance or facility control mechanisms that enables them to revoke the control mechanism at any time to include modified numeric limits or BMPs. For example, the POTW may find it necessary to revoke an Industrial User's control mechanism where the POTW determines that the user has not complied with applicable BMPs or where the POTW determines that it is easier to determine compliance with a numeric limit.

• *Any other requirements as determined by the Control Authority*.

There are at Least Two Ways to impose BMPs in Permits:

(1) by requiring the Industrial User to develop and implement BMPs (either a comprehensive plan or a plan addressing specific problems); or

(2) by imposing site or pollutant-specific requirements (e.g., removing or sealing floor drains or containing stored chemicals). The applicable BMP conditions may be incorporated in multiple sections of a permit since BMP requirements can include special monitoring requirements or activities, reporting and recordkeeping requirements, and/or treatment requirements.

If the BMP includes an implementation of a plan, the plan should be reviewed when submitted; but it is not generally necessary or advisable for the Control Authority to approve the plan. Compliance with the plan cannot relieve the Industrial User of its liability if its discharge causes or contributes to pass through or interference. Approval of the plan could be misconstrued as Control Authority sanction even though the plan when implemented might not be effective in controlling slug loads or other problematic discharges. The Control Authority has the discretion to reject any BMP that it deems to be inadequate to prevent interference, pass through, or violate the specific prohibitions.

When incorporating special conditions in the control mechanism, the permit writer should use language that clearly identifies what specific activities must occur and when they must occur or be completed. Examples of activities include criteria, specifications, and timeline of installation of treatment and requirements for O&M of treatment units.

Additional information on BMPs is in Appendix H. For more information, see the following EPA documents:

• *Guidance Manual for Control of Slug Loadings to POTWs*
• *Guidance Manual for Implementing Total Toxic Organics (TTO) Pretreatment Standards*
• *NPDES Best Management Practices Guidance Document*
• Appendix W—Best Management Practices Mini-Case Studies in the *Local Limits Development Guidance*

A slug discharge control plan is a specific type of BMP. A slug discharge is any discharge of a nonroutine episodic nature, including an accidental spill or a noncustomary batch discharge, that has a reasonable potential to cause interference or pass through or in any other way violate the POTW's regulations, local limits, or permit conditions [40 CFR 403.8(f)(2)(vi)].

If the Control Authority determines actions to control slug discharges are necessary, the SIU's permit must include provisions addressing those requirements to control slug discharges [40 CFR 403.8(f)(1)(iii)(B)(6)]. As noted previously, the Control Authority should review the SIU's slug discharge control plan to ensure that the plan contains all of the federal requirements, but the Control Authority should not approve the plan.

EPA expects that POTWs will include language in the permit that requires control of slug discharges rather than the terms of a particular SIU's plan. Including the entire slug discharge control plan could prove to be administratively burdensome because changes made to the plan during the term of the permit could require the Control Authority to modify the permit or reopen and reissue the permit.

6.2 Applying Effluent Limits

It is important that the permit writer correctly apply the effluent limits in the permit. The permit should clearly designate the sampling point(s) where the limits apply, the period in which the limits apply (e.g., from a specific date to a specific date if different from the effective period of the permit), and the units (e.g., mg/L or lbs/day). In addition, the effluent limits should be expressed in terms of the duration for which the limits themselves are intended to apply (e.g., instantaneous maximum, maximum daily, or monthly average) and such terms should be well defined.

For example, an instantaneous maximum value is the maximum concentration of a pollutant allowed to be discharged at any time, determined from the analysis of any discrete or composited sample collected, independent of the industrial flow rate and the duration of the sampling event. On the other hand, a maximum daily discharge limit is defined as the highest allowable *daily discharge,* and daily discharge is defined as the discharge of a pollutant measured during a calendar day or any 24-hour period that reasonably represents the calendar day for the purposes of sampling. For pollutants with limits expressed in units of mass, the daily discharge is calculated as the total mass of the pollutant discharged over the day. For pollutants with limits expressed in other units of measurement, the daily discharge is calculated as the average

6.2.1 What Other Pollutants Are Present?

The permit writer should review the permit application and other supplemental materials requested from the Industrial User. For example, analytical data on wastewater quality indicate actual pollutants present before treatment and the concentration/strength of the pollutants in the wastewater.

The permit writer can use a list of raw materials to identify additional possible pollutants that could be present in the wastestream. In addition, the permit writer should review flow data to identify variability in pollutant and hydraulic loadings.

If the permit writer identifies additional pollutants present that are not regulated by categorical Pretreatment Standards, the permit writer should either determine if local limits are already established or need to be developed for these pollutants. If these pollutants do not have local limits, the permit writer could consider obtaining additional monitoring data to determine if local limits are needed for these pollutants. The permit writer is reminded that all applicable local limits must be included in the permit.

6.2.2 Relationship of Local Limits to Categorical Pretreatment Standards

Categorical Pretreatment Standards and local limits are distinct and complementary types of Pretreatment Standards. Promulgation of a categorical Pretreatment Standard by EPA in no way relieves a Control Authority from its obligation to evaluate the need for, and to develop, local limits to meet the general and specific prohibitions in the General Pretreatment Regulations. As mentioned earlier, categorical Pretreatment Standards are developed to achieve a degree of water pollution control for selected industries and pollutants on the basis of a national assessment of available technology and costs. Local limits are intended to prevent site-specific POTW and environmental problems resulting from Industrial Users.

In implementing its pretreatment program, a Control Authority is required to enforce the *applicable Pretreatment Standard* (i.e., federal, state, or local, whichever is most stringent). When the Control Authority is drafting a permit for an Industrial User subject to categorical Pretreatment Standards, the task of applying the applicable effluent limits can be complicated. Local limits are often more stringent than categorical Pretreatment Standards because they are based on local, site-specific situations. In addition, there might be local limits for more pollutants than are regulated in the applicable categorical Pretreatment Standard. Therefore, a permit may contain a mixture of categorical Pretreatment Standards and local limits. One complicating factor is that, in contrast to the categorical Pretreatment Standards that apply to individual discharges from regulated processes (end-of-process), local limits normally apply at the point(s) of discharge to the public sewer system (end-of-pipe).

In the situation where the Industrial User's discharge to the public sewer contains *only* wastewater from a process regulated under a particular categorical standard, the end-of-process pollutant load is the same as measurement of the pollutant over the day [40 CFR 122.2]. In the situation where the Industrial User's discharge to the public sewer contains *only* wastewater from a process regulated under a particular categorical standard, the end-of-process pollutant load is the same as the end-of-pipe pollutant load. The determination of which limits apply, local or categorical, is accomplished by simply choosing the limit that is numerically more stringent if the terms of duration of the limits are the same (e.g., both limits are daily maximum limits or monthly average limits). More commonly, the industry's discharge at the point of connection contains a mixture of categorical process wastestreams and noncategorical process wastestreams.

If categorical standards are to be applied at the end-of-pipe where additional wastestreams exist, the permit writer must adjust the categorical Pretreatment Standards to end-of-pipe limits. Appendices I and J contain guidance for calculating production-based standards and using the CWF, respectively. Such adjusted limits must then be compared to the Control Authority's local limits, and the most stringent limit would be included in the permit. The example in Table 6-6 illustrates the results of comparing federal and local limits.

In other instances, the Control Authority might find it necessary or preferable to monitor the industrial discharge at more than one location. In such a case, the permit must clearly indicate where the specific limits apply and where samples for various parameters must be collected. For example, a Control Authority might want to regulate a metal-finishing industry by requiring monitoring for local limits at the connection to the sewer system, monitoring for categorical Pretreatment Standards at the discharge from the treatment facility, and monitoring for cyanide on the segregated wastestream from the cyanide treatment unit.

EXAMPLE OF FACT SHEET DOCMENTING THE DETERMINATION OF THE MOST STRINGENT DAILY MAXIMUM EFFLUENT LIMITS

Parameter	Daily PSES	Monthly PSES	Daily CWF	Monthly CWF	Local Daily Limits	Daily Final Limit	Monthly final limit**
Cadmium	0.69	0.26	0.46	0.17	0.10	0.10	0.17
Chromium (Hex)	________	________	________	________	0.10	0.10	________
Chromium (Total)	2.77	1.71	1.85	1.14	1.0	1.0	1.14
Copper	3.38	2.07	2.26	1.38	5.0	2.26	1.38
Cyanide	6.0	0.65	*	*	2.0	2.0	0.65*
Lead	0.69	0.04	0.46	0.29	0.10	0.10	0.29
Manganese	--------	---------	---------	---------	1.00	1.00	---------
Mercury	---------	---------	---------	---------	0.005	0.005	---------
Nickel	3.98	2.38	2.66	1.59	2.0	2.0	1.59
Silver	0.04	0.24	0.28	0.16	0.1	0.1	0.16
Zinc	2.61	1.48	1.74	0.99	5.0	1.74	0.99
TTO* **	2.13	---------	1.42	---------	1.0	1.0	---------

Note: All concentrations are in mg/L unless otherwise noted.

Key:
PSES = Pretreatment Standards for Existing Sources, metal finishing category (40 CFR Part 433.15 (a))

CWF = Alternative metal - finishing standards after use of the combined wastestream formula.

Local Limits = Maximum pollutant concentrations established by the Control Authority

Final Limit = Final limits based on most stringent of local, state, and federal standards

*Cyanide limits must apply to the segregated cyanide wastestream of the cyanide destruct treatment process

**The discharger required to comply with both the daily maximum and monthly average limits, if applicable.

***The pollutants regulated by the categorical TTO limit and the local TTO limit are the same.

6.2.3 Concentration - or - Mass-Based Limits

As noted in Section 6.1.1.1, the Control Authority may have the authority to establish equivalent mass limits or equivalent concentration limits for federally established concentration-based and mass-based limits, respectively. The Control Authority might also want to establish the same flexibility when applying its local limits. The permit writer needs to be familiar with how the local limits were developed, how they are meant to be implemented, and how they were adopted into the sewer use ordinance.

Local limits are generally expressed as numeric values, which are upper bounds of the amount of pollutant that may be discharged to the POTW by Industrial Users. During the local limits development process, the quantity of specific pollutants that may be accepted by the POTW is developed as a mass value (pounds per day) or otherwise known as maximum allowable industrial loadings. Then the maximum allowable industrial loading value is typically divided among all Industrial Users subject to local limit requirements and converted into a concentration-based limit. Typically, most POTWs implement their numeric limits as uniform, concentration-based local limits. (For more information regarding local limits development and implementation, see EPA's *Local Limits Development Document*, July 2004).

When to Convert Concentration-Based Local Limits to Mass Limits
There might be circumstances when applying an equivalent mass limit is more appropriate than applying a concentration limit. Before converting concentration-based local limits to mass limits, the permit writer should review how the local limits were originally established to determine the maximum allowable loading values allocated for each Industrial User. By converting concentration-based local limits to mass limits, the permit writer ensures that the maximum allowable loading allocated to that Industrial User is not exceeded and that compliance is not achieved through dilution. The following are some situations in which the permit writer should consider converting concentration-based local limits into mass limits:

Batch dischargers
- Dischargers with excessive or variable wastewater flow
- Dischargers with seasonal variations

To evaluate compliance with the equivalent mass limit, the permit writer must obtain or require the Industrial User to submit appropriate flow measurements of the wastewater discharged to the POTW.

The applicable formula is shown on following table known EPA Table 6-7

When to Convert Mass-Based Local Limits to Concentration Limits
Even though local limits are typically concentration-based limits, some POTWs have adopted mass-based local limits. If your POTW has adopted mass-based local limits, there might be situations when these limits should be converted to concentration limits. By converting mass-based local limits to concentration limits, the Control Authority can evaluate compliance with effluent requirements of local limits by simply comparing the analysis result with the numeric limit. The following are some situations in which the permit writer should consider converting mass-based local limits to concentration limits.
- Dischargers with consistent wastewater discharge flow rates
- Dischargers with consistent compliance

The applicable formula is shown on following table known EPA Table 6-7.

(Concentration-based limits (mg/L) to mass limits (lbs/day))
(User's Discharge Flowrate In million gallons per day (mgd)) x (Concentration-based limit In milligrams per liter (mg/L)) x (Conversion factor 8.34 lbs/gal) = Equivalent mass limit, lbs/day
(Mass-based limits (lbs/day) to concentration limits)
(User's Allowable Pollutant loading (pounds per day (lbs/day))) / [(User's average daily discharge flowrates (mgd)) (Conversion factor 8.34 lbs/gal)] = Equivalent concentration limit, mg/L

6.2.4 NSCIU Requirements

The Control Authority, at its discretion, may establish the authority to classify some CIUs as NSCIUs. If the Control Authority has established this authority, the Control Authority should consider how it would regulate its NSCIUs. Because NSCIUs are no longer considered significant users, there is no federal requirement to control these users through a permit or any other control mechanism. The Control Authority, however, at its own discretion, can establish the authority to issue permits to these users.

Regardless of whether an Industrial User is determined to be an NSCIU, it is still a categorical discharger and, as such, is still required to comply with applicable categorical Pretreatment Standards and related reporting and notification requirements at 40 CFR 403.12(b), (c), (d), (f), (j), (l), and (p).

Furthermore, the Control Authority still must perform the same minimum oversight of an NSCIU that is required for other facilities that are not SIUs, including notifying the CIU of its status and requirements, reviewing required reports and certifications, verifying that daily regulated flow rates do not exceed 100 gpd, random sampling and inspection, and investigating noncompliance as necessary.

If the Control Authority has established the necessary authority to permit these dischargers, the permit writer should include the following:

- Applicable categorical and local effluent limitations
- Necessary reporting and notification requirements.

6.2.5 Zero-Discharge Requirements

The Control Authority, at its discretion, may prohibit the discharge of certain wastewaters (e.g., storm water, chlorinated swimming pool waters) into the POTW, in addition to the general federal prohibitions.

Furthermore, some categorical pretreatment standards require a facility to not discharge certain process wastewaters. For those facilities, the permit writer should evaluate whether there is a potential for the facility to actually discharge the prohibited process wastewater into the POTW. Considerations for "potential" are discussed in detail in Section 3.2 of this manual.

A Control Authority may choose to issue a permit to a facility that does not discharge (zero-discharge) or is prohibited to discharge process wastewater. There are special conditions that the Control Authority should include in the permit for this type of facility. These conditions are discussed in detail in a later topic.

6.2.6 Tiered Permits

The Control Authority could encounter situations in which one set of effluent limits might not be appropriate for the permit's entire period (e.g., where production rates and associated wastestream volume discharged varies). A tiered permit might be appropriate in such situations, eliminating the need for continual permit revisions. For example, an Industrial User may be issued one set of limits for the average production rate and another set that takes effect when there is a significant change in the average production rate.

Generally, a 10 to 15 percent deviation above or below the long-term average production is within the range of normal variability. Predictable changes in the long-term production higher than that range could warrant consideration of a tiered permit. Tiered permits are recommended where the long-term average production varies by 20 percent or greater. Typically, there are three situations in which tiered permits are warranted.

The first situation would involve a facility that the Control Authority knows will begin a new process or add a new process line during the term of the permit. In such a case, the permit writer could include two sets of limits—one set for the current conditions and one set for the future conditions. The permit should also clearly state the terms and conditions under which each set of limits would apply.

The second situation would involve an industry that has an annual pattern of low- and high-production rates. For example, an industry that produces Christmas items might operate at only 40–50 percent capacity from January through June, but at full capacity from July through December. In such a case, the permit writer would also develop two (or more) sets of limits for the industry.

For seasonal variations, the permit could stipulate either dates or production levels that would trigger the application of one set of limits versus another. For that type of permit, a special condition should be included in the permit that requires the Industrial User to notify the Control Authority when the scheduled production change occurs *or* if unexpected circumstances cause seasonal operations to differ from the fixed periods defined in the permit.

The third scenario would involve an industry where the demand is variable, and the permit modification process is not fast enough to respond to the need for higher or lower equivalent limits.

A permit might be written with two or three tiers that apply to ranges of production.

For example, a hypothetical battery plant has a historical average production rate that varies between 40 and 100 percent with a maximum average production rate of 2.0 x 106 lbs/day.

The plant is subject to a production-based categorical standard for pollutant X – 1 lb/million lb of product (daily maximum).

Alternate Effluent Limits Might be set as Follows:

First Tier: Basis of Calculation. 1 × 106 lbs/day Limit for Pollutant X 2.0 lbs/day (daily maximum)

Applicable Production Range: 0.8 × 106 to 1.2 × 106 lbs/day

Second Tier: Basis of Calculation. 1.4 x 106 lbs/day Limit for Pollutant X 2.8 lbs/day (daily maximum)
Applicable Production Range: > 1.2 × 106 to 1.6 × 106 lbs/day

Third Tier: Basis of Calculation. 1.8 × 106 lbs/day Limit for Pollutant X 3.6 lbs/day (daily maximum)

Applicable Production Range: > 1.6 × 106 to 2.0 × 106 lbs/day

The first tier has an applicable production range that covers plus or minus 20 percent of the basis of the calculation for that tier. This can be seen by noting that the basis of calculation for the first tier is 1 × 106 lbs/day, and the threshold level that would trigger the next tier is set at 1.2 × 106 lbs/day or 20 percent higher.

Similarly, the second and third tiers have applicable production ranges of 14 percent and 11 percent, respectively. That is consistent with the general rule (mentioned earlier) that a 10 to 15 percent change in average production rate is within the range of normal variability while a 20 percent or greater change should warrant alternate limits.

The production range for each tier must be specified in the permit, and the Industrial User must be required to report the measurements or estimates of the actual production rate that prevailed during the reporting period. The anticipated production rate for the next reporting period should also be reported.

For a tiered permit, a special notification condition should be included in the permit that requires the Industrial User to notify the Control Authority within 30 days before a change in production.

A tiered permit requires an increased technical and administrative role by the Control Authority to verify compliance with effluent limits. The permit should be issued only after careful consideration and only when a substantial change in the long-term average rate of production or other changes that effect permit conditions are likely to occur.

Topic 6 - Effluent Limitations Post Quiz

Categorical Pretreatment Standards

1. Categorical Pretreatment Standards are technology-based standards for a selected group of industries established by EPA under authority of the CWA. These standards are developed on the basis of industry-wide studies of current ________________ (e.g., treatment technology) and, therefore, establish national baseline pollution control requirements for the regulated industrial categories.

2. Pretreatment Standards are generally promulgated for both existing sources and new sources. These standards could be the same or different. If an Industrial User is subject to categorical Pretreatment Standards, the permit writer must include _______________based on these standards in the user's permit.

3. If the Control Authority has determined that a monitoring waiver is appropriate, the permit must still contain the applicable _________________ with waived monitoring requirements.

Rules for Applying Categorical Pretreatment Standards

4. Categorical standards apply directly to specific wastestream or at the end of treatment of that wastestream. When the designated sampling location described in the permit contains a _____________________ and one or more other wastestreams not regulated by the same categorical standard, an alternative categorical limit must be calculated.

5. If effluent limits have both the daily maximum and the _______________ Pretreatment Standards, both limits must be included in the permit.

6. Limitations on *all* pollutants regulated by the __________________ must be included in the permit.

Rules for Production-Based Categorical Pretreatment Standards

7. Incorporating production-based categorical Pretreatment Standards in permits involves _____________________. The standards are expressed in terms of an allowable pollutant mass discharge per unit of production, such as pounds of pollutant per 1,000 pounds of product produced.

8. The standards can be placed in the permit verbatim from the regulations. The permit should then require the Industrial User to submit actual production data from the date(s) on which the compliance samples were collected and to calculate the actual mass of pollutant(s) discharged, on the basis of __________________, to evaluate compliance for that specific day.

9. Often, it might be impractical or difficult for the Control Authority to independently determine or verify compliance because the production rate and the ___________________ and pollutant concentration must be known. The Control Authority has the option of using equivalent mass or concentration limits [40 CFR 403.6(c)].

10. Such limits use an industry's long-term average daily production and flow rates to derive the corresponding daily maximum and ______________________.

11. The Industrial User permit may function as the _________________ for the conversion of production-based standards to equivalent mass or concentration limits. These equivalent limits are deemed Pretreatment Standards under section 307(b) of the CWA and are federally enforceable.

A Permit Containing Equivalent Limits Must Clearly Specify:
The flow and production rates upon which the limits are based;

12. The requirement that the Industrial User report a reasonable measure of its _____________ in each periodic compliance report.

Rules for Applying Equivalent Mass Limits for Concentration Limits
13. For an Industrial User to be eligible for equivalent mass limits, the user must do the following: Employ or demonstrate that it will employ ____________________ and technologies that substantially reduce water use during the term of its permit.

14. Currently use control and treatment technologies adequate to achieve compliance with the applicable categorical Pretreatment Standards and not have used _____________________ as a substitute for treatment.

15. Provide sufficient information to establish the facility's actual average daily flow rate for all wastestreams, on the basis of data from a_____________________, as well as the facility's long-term average production rate. Both the actual average daily flow rate and long-term production rate must be representative of current operation conditions.

16. Not have daily flow rates, production levels, or pollutant levels that vary so significantly that equivalent mass limits are not appropriate to control the ________________.

17. If the Control Authority chooses to establish equivalent mass limits, it may retain the same equivalent mass limit in subsequent permit terms if the user's actual average daily flow rate was reduced solely as a result of implementing water-conservation methods and the actual average daily flow rate used in the original calculation of the equivalent mass limit was not based on the use of____________________________________.

Specific Prohibitions:
The following pollutants must not be introduced into a POTW:

18. What is the term used that may create a fire or explosion hazard in the POTW, including, but not limited to, wastestreams with a closed cup flashpoint of less than 140 degrees Fahrenheit or 60 degrees Centigrade using the test methods specified in 40 CFR 262.21 [40 CFR 403.5(b)(l)]

19. Pollutants that will cause corrosive structural damage to the POTW, but in no case discharges with pH lower than 5.0, unless the POTW is specifically designed to accommodate such ____________________________ [40 CFR 403.5 (b) (2)]

20. Any pollutant, including oxygen demanding pollutants (BOD, and the like) released in a discharge at a flow rate or _____________________ that will cause interference with the POTW [40 CFR 403.5(b)(4)]

Topic 7 - Monitoring and Reporting Requirements

Topic 7 - Section Focus: You will learn the basics of industrial/commercial POTW monitoring and reporting. At the end of this section, you will be able to understand and describe Clean Water Act's rule concerning pretreatment requirements of monitoring and reporting of various industrial users and the importance of proper documentation. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 7 – Scope/Background: The Industrial Pretreatment program requires the permit writer to establish monitoring and reporting requirements. The Control Authority should consider several factors in determining the specific requirements to be imposed. Basic factors that affect sampling location, sampling method, sampling frequency, and reporting frequency are as follows:

- Applicability of categorical Pretreatment Standards
- Effluent and process variability
- Flow or pollutant loading or both
- Type of pollutant

7.1 Monitoring and Reporting of Various Industrial Users

Once an Industrial User's effluent limits are developed, the permit writer's next step is to establish monitoring and reporting requirements. Requiring the Industrial User to routinely self-monitor and to report the results of such monitoring enables the Control Authority to keep informed of characteristics of the user's discharge and compliance status so that any necessary permit modifications or enforcement actions can be initiated. Periodic self-monitoring also serves as a reminder to the Industrial User that compliance with the effluent limits is its responsibility. If an Industrial User is not monitoring, it does not know how well the pretreatment controls are working.

The Control Authority should be aware of and concerned with the potential problems of self-monitoring, such as improper sample collection or preservation, poor analytical techniques, and falsification of records. To prevent or minimize such problems, the permit writer should clearly detail monitoring and reporting requirements in the permit.

The permit's monitoring and reporting section should contain specific requirements for each of the following items:

- Sampling location
- Pollutants to be monitored, including pollutants with a sampling waiver
- Sample collection method
- Monitoring frequencies
- Analytical methods
- Reporting and certification requirements

The Control Authority should consider several factors in determining the specific requirements to be imposed. Basic factors that affect sampling location, sampling method, sampling frequency, and reporting frequency are as follows:

- Applicability of categorical Pretreatment Standards
- Effluent and process variability
- Flow or pollutant loading or both
- Type of pollutant

The permit writer must carefully consider such factors because any error can lead to inaccurate compliance determination or misapplication of federal or local requirements. In particular, several categorical Pretreatment Standards contain special monitoring requirements for specific regulated pollutants. Table 7-1 contains some examples of these special monitoring requirements.

EPA has clarified, in the preamble to the October 17, 1988, revisions to the General Pretreatment Regulations [53 FR 40562; October 17, 1988], that a flow proportioning formula or a more stringent calculation must be used to calculate alternate categorical Pretreatment Standards where other flows combine *after* treatment but before sampling. For an explanation of calculating adjusted categorical limits, the permit writer should refer to Appendix J, Combined Wastestream Formula Fact Sheet.

In addition, the Control Authority can require analytical, engineering and other data to determine the adjusted limits, or the Control Authority can require two sample points (sampling points before and after the mixing of additional wastestreams).

TABLE 7-1 EXAMPLES OF SPECIAL MONITORING AND REPORTING REQUIREMENTS FOR SPECIFIC CATEGORICAL PRETREATMENT STANDARDS

Electroplating [40 CFR Part 413]
• In lieu of routine monitoring for TTO, facilities may certify that toxic organics are not used in the facility or are controlled through a Toxic Organics Management Plan (TOMP). The TOMP and certification statements must be submitted to the Control Authority.
• If monitoring for TTO pollutant is necessary to measure compliance, the facility is required to analyze only for those pollutants expected to be present.
- The owner or operator certifies in writing that no cyanide is used.

Pharmaceutical Manufacturing [40 CFR Part 439]
• Unless otherwise noted, self-monitoring must be conducted at the final effluent discharge point.
• If monitoring for cyanide at end-of-pipe is impractical because of dilution, compliance with the cyanide standard established in subparts A and C must be demonstrated at in-plant monitoring points pursuant to 40 CFR 403.6(e)(2) and (4).
• The Control Authority may impose monitoring requirements on internal wastestreams for any other parameter regulated by subparts A and C.
• In lieu of conducting compliance monitoring for the pollutants regulated in all subparts, the Industrial User can certify that the regulated pollutants are neither used nor generated.

Pulp, Paper, Paperboard [40 CFR Part 430]
• Specific monitoring frequencies for chlorinated organic pollutants for subparts B and E are listed at 40 CFR 430.02(a). The duration of this required monitoring is listed at 40 CFR 430.02(b).
• Reduced monitoring frequencies for bleach plant pollutants are allowed under the Voluntary Advanced Technology Incentives Program as specified at 40 CFR 430.02(c) and (d).

Transportation Equipment Cleaning [40 CFR Part 442]
• The facilities may in lieu of achieving the Pretreatment Standards established in subparts A and B develop and implement a Pollutant Management Plan and submit a certification statement indicating intent to do so.

Electrical and Electronic Components [40 CFR Part 469]
• In lieu of routine monitoring for TTOs, facilities may certify that toxic organics are not used in the facility or are controlled through a solvent management plan. The solvent management plan and certification statements must be submitted to the Control.

Coil Coating [40 CFR Part 465]
• The facilities may be exempted from cyanide monitoring if:
- The first cyanide sample collected during the calendar year is less than 0.07 mg/L of cyanide; and,
- The owner or operator certifies in writing that no cyanide is used.
• As an alternative to monitoring for TTOs in subpart D, the facilities may meet the alternative oil and grease standard and must monitor for oil and grease using the analytical method outlined in 40 CFR 465.03(c).

Leather Tanning [40 CFR Part 425]
• The analytical method specified for sulfide in 40 CFR 425.03 must be used for determination of sulfide in alkaline wastewaters discharged by plants operating in all subcategories except subpart C.
• Facilities may be exempt from the sulfide standard if the Control Authority submits a written certification to EPA that the sulfide does not interfere with the treatment works.

Metal Finishing [40 CFR Part 433]

• Monitoring for compliance with the cyanide limit must be conducted after cyanide treatment and before dilution with other wastestreams. If monitoring the segregated cyanide wastestream cannot be done, then samples of the facility's final effluent may be taken, if the applicable cyanide limitations are adjusted based on the dilution ratio of the cyanide wastestream flow to the facility's effluent flow.

• In lieu of routine monitoring for TTO, facilities may certify that toxic organics are not used in the facility or are controlled through a TOMP. The TOMP and certification statements must be submitted to the Control Authority.

• If monitoring for TTO pollutant is necessary to measure compliance, the facility is required to analyze only for those pollutants expected to be present.

Porcelain Enameling [40 CFR Part 466]

• Facilities may be exempted from chromium monitoring if:

- The first sample collected during the calendar year is less than 0.08 mg/L of chromium; and,
- The owner or operator certifies in writing that chromium is not used.

Sampling locations must be safe, convenient, and accessible to Industrial User and Control Authority personnel. If there is no ready access to a representative sampling point, the Control Authority should require the permittee to provide such access including, if necessary, installation of sampling manholes. The sampling location(s) chosen should also allow the measurement or estimation of the volume of wastewater flow.

Because the Control Authority's local limits generally apply to the entire discharge from an Industrial User, a sewer manhole at the connection between the industrial facility's sewer pipe and the Control Authority's sewer pipe is usually selected as the sampling point. Such a sampling manhole allows easy access by the Control Authority and usually facilitates collecting a sample of the user's total discharge.

However, in some cases, the manhole could contain wastewater discharges from upstream domestic or other Industrial Users connected to the Control Authority's sewer pipe, making it impossible to obtain a sample of any *one* Industrial User's discharge. In such a case, the Control Authority should identify a more appropriate sampling location.

Another important factor that must be considered when establishing an appropriate sampling location at an industrial facility subject to categorical Pretreatment Standards is the collection of representative samples. Categorical Pretreatment Standards are numerical limits that apply to specific regulated wastestreams before the wastestreams are mixed with other flows.

Because of that, the sampling point(s) chosen must provide representative samples of categorical wastestreams and should be after treatment of the categorical wastestreams if treatment is used. If other wastestreams are combined *before* treatment, and sampling of the effluent occurs after treatment, then alternate discharge limits must be established to account for the dilution effect of these wastestreams. However, if the other wastestreams are combined after treatment but before the facility's monitoring point, a different formula must be used [40 CFR 403.6(e)].

TABLE 7-2 EXAMPLES OF SPECIFYING SAMPLING LOCATIONS IN PERMITS

EXAMPLE OF SPECIFYING SAMPLING LOCATION BY NARRATIVE DE-

Pipe 01A is defined as the sampling site from the industry's process wastewater discharge downstream from the existing treatment clarifier. Note that the upgraded treatment system becomes operational, the sampling site will be the first manhole downstream from the sand filters.

EXAMPLE OF MULTIPLE SAMPLING LOCATIONS SPECIFIED BY NUMBER DESIGNATION

IV. SELF-MONITORING REQUIREMENTS

A. Sample Locations

1. Discharge from the Chemistry-Fine Arts Building must be sampled at the Manhole No. 50
2. Discharge from the Duane Physics Building must be sampled at the Manhole No. 22
3. Discharge from the Research Lab No. 1 must be sampled at the Manhole A.

EXAMPLE OF SAMPLING LOCATION SPECIFIED BY DIAGRAM

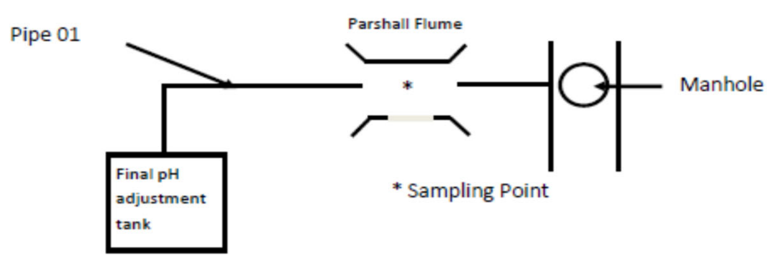
Part I Permit No. 001

Part 1. Effluent Limitations and Monitoring Requirements

A. Description of Discharges

Pipe ***Description***

01 Discharge Pipe—Discharge of wastewater generated by all regulated metal-finishing processes at the facility. Samples must be collected at the point indicated on the attached diagram.



The permit writer must consider each of the above factors to identify the most practical and most representative sampling location(s). Once the sampling locations are selected, the permit writer must clearly specify the sampling locations in the permit. The permit writer should not assume that the sampling locations are known by other Control Authority staff or by the permittee. Changes in either Control Authority or industrial personnel can result in loss of knowledge of the exact sampling location unless the sampling locations are clearly defined in the permit. Examples in Table 7-2 illustrate three ways of specifying sampling locations by using brief narrative descriptions, designation by numbers, and a diagram. If one or more sampling points are identified, each location and the limits and any applicable monitoring requirements that apply should be clearly specified in the Industrial User's permit.

7.2 Pollutants to be Monitored

The POTW should always require Industrial User self-monitoring for all pollutants limited by specific numerical values in the Industrial User permit. Industrial Users subject to categorical Pretreatment Standards are required to monitor and report the analytical results for all regulated pollutants to comply with the reporting requirements of 40 CFR 403.12(e) of the General Pretreatment Regulations unless the Control Authority has authorized the discharger to forgo sampling of a pollutant that is neither present or expected to be present. For further guidance on how to conduct an assessment of whether pollutants are expected to be present in particular wastestreams, see Section 6.1.1.1 of this manual.

Some categorical Pretreatment Standards allow alternatives to sampling specific regulated pollutants. The permit writer must review the specific monitoring and reporting requirements contained in the applicable categorical pretreatment regulations. In addition, EPA's *Guidance Manual for Implementing Total Toxic Organics (TTO) Pretreatment Standards* contains guidance on the TTO monitoring alternatives.

The Control Authority is not required to limit the pollutants to be sampled to only those subject to effluent limits. It may require the Industrial User to monitor for other pollutants of potential concern. In such a case, a monitoring-only requirement may be included as an additional condition of the permit (discussed in more detail in Topic 10). The permit writer should also require the Industrial User to monitor flow (even if flow is not limited). A flow-monitoring requirement is necessary where mass limits are imposed to determine compliance with mass limits. In addition, flow-monitoring is required when the Control Authority is converting concentration-based categorical Standards to an equivalent mass limit [70 FR 60173; October 14, 2005, 40 CFR 403.6(c)(5)(iii)(A)]. A flow-monitoring requirement can also serve as a reminder to collect flow data for those SIUs that are required to report daily maximum and average flows in semiannual reports [40 CFR 403.12(g)].

7.3 Sample Type

The permit must specify the sample collection method or type of sample(s) for each pollutant to be monitored. In general, two types of samples may be taken: grab or composite. The permit writer should review the sampling objectives and the advantages and disadvantages of each sample type. According to the sampling requirements specified at 40 CFR 403.12(g)(3), grab samples must be used for pH, cyanide, total phenols, oil and grease, sulfide, and volatile organic compounds.

For all other pollutants, 24-hour composite samples must be obtained through flow-proportional composite sampling techniques, unless the Control Authority authorizes time-proportional sampling or grab sampling. Where the Control Authority authorizes time-proportional sampling or grab sampling, the samples must be representative of the discharge, and the decision to allow the alternative sampling must be documented in the Industrial User file for that facility or facilities.

Because two types of composite samples exist—flow proportional and time proportional—the permit writer should clearly specify or define the sample type. The sample period should also be specified. Generally, the sample period is 24 hours, but if the Industrial User's discharge is for only 8 hours each day, the permit writer could specify that the composite sample be collected over the 8 hours of discharge. The number of grab samples should be specified (e.g., a grab sample taken after a specified volume of wastewater has been discharged or a minimum of four per day at equal time intervals).

7.3.1 Grab Sample

A grab sample is a single, discrete sample collected over a period not exceeding 15 minutes, without any regard to the wastestream's flow. Grab samples may be used when both wastewater flow and pollutant concentrations (or pollutant loadings) are constant over time. Grab samples may also be used for batch discharges, such as a contaminated process tank that is periodically discharged. However, a batch discharge must be homogeneous to be accurately represented by a grab sample.

Grab samples are useful in characterizing an Industrial User's fluctuations or extremes in wastewater flow and quality (i.e., changes in pollutant concentrations or loadings) and, therefore, are useful in identifying slug loads. Such samples are also appropriate to determine compliance with *instantaneous* effluent limits, where a composite sample could mask extreme conditions in the wastewater. The pH parameter can illustrate this concept clearly: a composite sample could exhibit a neutral pH, while individual grab samples could exhibit a wide range of pH.

Grab samples should be used when storing or compositing a sample would alter the concentration or characteristics of pollutants being measured. Parameters that necessitate grab sampling techniques include pH, oil and grease, temperature, total phenol, cyanide, sulfides, and some volatile organics (purgeable halocarbons, purgeable aromatics, acrolein, and acrylonitrile).

7.3.2 Composite Sample

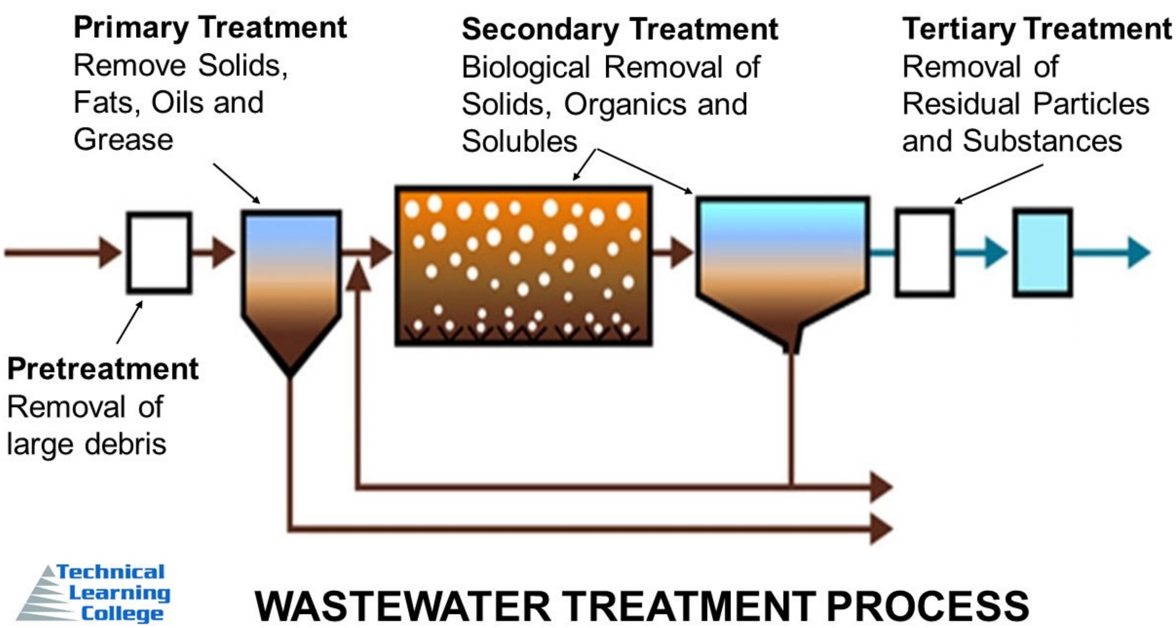
Composite samples are used to measure the average amount of pollutants discharged by an Industrial User during the composite period. Composite samples are preferred when evaluating compliance with 24-hour or daily average concentration limits and mass limits. Samples may be obtained as either time-proportional or flow-proportional.

For a flow-proportional composite sample, each individual aliquot is collected after a defined volume of discharge (e.g., every 2,000 gallons) has passed. Flow-proportional composite samples are collected when both an Industrial User's effluent flow and pollutant concentrations or loadings exhibit irregular changes.

For pollutants for which grab samples are not necessary, flow-proportional composite samples should always be used to determine compliance with categorical Pretreatment Standards. For a time-proportional composite sample, each individual aliquot is collected after a defined period (e.g., once every two hours) has passed, regardless of the volume or variability of the rate of flow during that period.

Time-proportional composite samples are generally collected under conditions of constant or slightly fluctuating effluent flows. For a nonhomogeneous batch discharge, wastes are stratified in a tank, and the effluent's quality will vary over the period of batch discharge. For such a situation, a time-proportional composite sample collected over the period of discharge would be most appropriate.

Flow-proportional compositing is usually preferred when effluent flow volume varies appreciably over time. However, the permit writer may specify time-proportional composite samples or grab samples where flow-proportional samples are not feasible and the use of such other sampling techniques would provide a representative sample.



7.4 Monitoring Frequencies

The Control Authority has considerable discretion in establishing monitoring frequencies. However, federal regulations [40 CFR 403.12(e)(l)] specify a minimum reporting frequency of twice per year to demonstrate *continued compliance* with categorical Pretreatment Standards except when the Control Authority has determined a CIU to be nonsignificant or when the Control Authority has reduced the discharger's monitoring and reporting requirements. The Control Authority must require monitoring and reporting, at least once every 6 months, from all other SIUs [40 CFR 403.12(h)].

Furthermore, monitoring must be conducted to satisfy BMR, 90-day compliance report, and repeat noncompliance monitoring reporting requirements pursuant to 40 CFR 403.12. In establishing monitoring frequencies, the permit writer's primary task is to achieve a reasonable balance between the need for sufficient representative data to assess compliance and the expense or burden of obtaining such data.

Each of the following factors should be considered by the Control Authority as it develops both the Industrial User self-monitoring requirements and its own compliance monitoring program:

- Frequency necessary to obtain data representative of the nature and volume of the Industrial User's wastewaters
- Amount of historical data available to characterize the industry's discharge (industries with no historical data should be sampled more frequently)
- Actual (or potential) impact of the Industrial User's wastes on the operation of the Control Authority's treatment plant, receiving stream, and sludge disposal practices
- Types of pollutants contained in a facility's wastewaters and the concentrations or loadings discharged
- The quantity of process and other wastewater discharged to the POTW
- Regulatory requirements of any existing Industrial User permits, local sewer use ordinances, POTW policy statements, or federal regulations and policies
- Any seasonal variations experienced in the Industrial User's manufacturing operations and wastewater flow
- Length of the Industrial User's operating day and the number of shifts worked per day
- Industrial User's history of upsets or accidental spills or lack of spill prevention plans for raw materials, process wastewaters, or chemicals stored on-site
- Reliability of the Industrial User's treatment facilities
- Any scheduled discharges of unusual or extraordinary strength or volume (i.e., batch discharges of process tanks or routine cleanup periods scheduled each day, week, or month)
- Compliance (or noncompliance) history of the Industrial User for, at a minimum, the past 2 years
- Expense of monitoring imposed on both the Industrial User and the Control Authority and the resources (labor and equipment) available.
- Design dry-weather hydraulic and organic capacity of the POTW
- MAHL of the technically based local limits

The Control Authority might wish to develop a base level monitoring frequency to be imposed on all Industrial Users and use the above factors to increase or decrease the monitoring frequencies on a case-by-case basis from the established base monitoring frequency. EPA recommends frequencies based on five flow categories using flow as an indication of the potential impact on a 5 mgd treatment plant and the ability of the user to bear the monitoring cost (see Table 7-3). The Control Authority could also adopt the monitoring frequency that EPA used in developing categorical Pretreatment Standards (generally, this frequency is 10 times per month for inorganics).

TABLE 7-3
RECOMMENDED INDUSTRIAL SELF-MONITORING FREQUENCIES DURING THE INITIAL COMPLIANCE PERIOD

Industrial flow (gpd)	Conventional pollutants, inorganic pollutants, cyanide, and phenol	GC or GC/MS organics
0—10,000	1/month	2/year
10,001—50,000	2/month	4/year
50,001—100,000	1/week	1/month
100,001—240,000	2/week	2/month
> 240,000	3/week	4/month

Note: Industrial Users subject to TTO standards in the Electrical and Electronic Components, Electroplating, and Metal Finishing categories may elect to implement a Toxic Organics Management Plan and submit periodic certification statements in lieu of performing TTO analyses. Industrial Users subject to TTO standards in the Aluminum Forming, Copper Forming, Coil Coating (Canmaking), and Metal Molding and Casting categories may monitor for oil and grease as an alternative to TTO monitoring.

Excerpt from: EPA's Pretreatment Compliance Monitoring and Enforcement Guidance

Industrial flow (gpd)	Conventional pollutants, inorganic pollutants, cyanide, and phenol	GC or GC/MS organics
0–10,000	1/month	2/year
10,001–50,000	2/month	4/year
50,001–100,000	1/week	1/month
100,001–240,000	2/week	2/month
> 240,000	3/week	4/month

Note: Industrial Users subject to TTO standards in the Electrical and Electronic Components, Electroplating, and Metal Finishing categories may elect to implement a Toxic Organics Management Plan and submit periodic certification statements in lieu of performing TTO analyses. Industrial Users subject to TTO standards in the Aluminum Forming, Copper Forming, Coil Coating (Can making), and Metal Molding and Casting categories may monitor for oil and grease as an alternative to TTO monitoring.

Excerpt from: EPA's Pretreatment Compliance Monitoring and Enforcement Guidance

Before reducing an Industrial User's monitoring frequency or classifying a CIU to be a middle-tier or nonsignificant CIU, the Control Authority must ensure that it has the legal authority to do so (i.e., the state and local regulations include the provision) and the program has been modified in accordance with 40 CFR Part 403.

For programs that have been modified to incorporate the NSCIU provision (in accordance with 40 CFR Part 403), the Control Authority has the option to classify a CIU as nonsignificant. If the Control Authority chooses to treat a qualifying CIU as an NSCIU, the Industrial User is still required to provide baseline monitoring and 90-day compliance reports (as required by 40 CFR 403.12(b) and (d)]. A qualifying CIU is a discharger that discharges no more than 100 gpd of total categorical wastewater to the POTW and has consistently complied with all applicable categorical Pretreatment Standards and Requirements, and never discharges any untreated, concentrated wastewater [40 CFR 403.3(v)(2)].

The NSCIU, however, is not required to conduct any subsequent monitoring and is not required to provide periodic compliance reports [40 CFR 403.12(e)]. As an NSCIU, the discharger is still considered a CIU, but is no longer considered an SIU and, therefore, is not required to be issued a control mechanism. An NSCIU, however is required to submit an annual certification statement signed in accordance with 40 CFR 403.12(l).

For programs that have been modified to incorporate the reduced monitoring provisions (in accordance with 40 CFR Part 403), the Control Authority also has the option to reduce a CIU's monitoring and reporting requirements to once per year under certain conditions (e.g., middle-tier CIU).

To qualify for the reduced monitoring and reporting, the discharger must meet all the following conditions:

- The discharger's total categorical wastewater flow does not exceed 0.01 percent of the design dry-weather hydraulic capacity of the POTW, or 5,000 gpd (whichever is smaller, as measured by a continuous effluent flow monitoring device unless the user discharges in batches); 0.01 percent of the design dry-weather organic treatment capacity of the POTW; and 0.01 percent of the MAHL for any pollutant regulated by the applicable categorical Pretreatment Standards for which approved local limits were developed by the POTW.
- The discharger has not been in significant noncompliance, as defined at 40 CFR 403.8(f)(2)(viii), for any time in the past 2 years.
- The discharger does not have daily flow rates, production levels, or pollutant levels that vary so significantly that decreasing the reporting requirement for this discharger would result in data that is not representative of conditions occurring during the reporting period.
- The discharger must notify the Control Authority immediately of any changes at its facility causing it to no longer meet the conditions of 40 CFR 403.12(e)(3)(i) or (ii). Upon notification, the discharger must immediately begin complying with the minimum reporting requirements of 40 CFR 403.12(e)(1).

Other Monitoring Considerations

For operations that are variable, the permit writer might want to require increased monitoring during peak operations, seasonal changes, or raw material changes. For batch discharges, monitoring frequencies could be geared to the frequency of discharge. For example, the permit writer could require a small electroplater that batch discharges once a month to monitor when the batch discharge occurs.

Alternatively, the permit writer could decide to require the batch discharger to monitor and submit the monitoring results to the Control Authority before the batch may be discharged.

For an example on how to specify monitoring frequencies, see Appendix E, Sample Permit Fact Sheet and Industrial User Permit. Additional monitoring requirements may be inserted in the monitoring requirements section of the permit or in the permit's special conditions section discussed in a later Topic.

7.5 Analytical Methods

The General Pretreatment Regulations [40 CFR 403.12] require that all analyses to determine compliance with categorical Pretreatment Standards be performed in accordance with 40 CFR Part 136, *Guidelines Establishing Test Procedures for the Analysis of Pollutants under the Clean Water Act* and amendments, or with any other test procedures approved by EPA (See 40 CFR 136.4 and 136.5). Analytical techniques for additional pollutants not contained in 40 CFR Part 136 must be performed by using validated analytical methods approved by EPA [40 CFR 403.12(g)(5)].

Requiring everyone to use such EPA-approved test methods ensures that analytical data are obtained uniformly and consistently. The EPA-approved test methods must also be used to determine compliance with state standards and local limits. If multiple methods are approved for the same parameter at 40 CFR Part 136, the analytical method used should have an appropriate quantification limit to determine compliance with the effluent limit. This requirement to use EPA-approved analytical methods should be specified in either the monitoring and reporting section or the standard conditions section of the permit as illustrated in Appendix E, Sample Permit Fact Sheet and Industrial User Permit.

7.6 Reporting Requirements

Along with establishing self-monitoring requirements, the permit writer must specify reporting requirements in the permit. At least once every 6 months, SIUs are required to submit a characterization of their discharge.

These periodic compliance reports must contain the following:

- The concentration, or production and mass, of regulated pollutants in the Industrial User's effluent
- The measured or estimated average and maximum flow rates for the reporting period
- Documentation to evaluate compliance with any BMP or pollutant prevention requirements

In cases where the Control Authority conducts all the sampling and analysis and the Control Authority collects the flow data, the Control Authority might determine that the Industrial User does not need to submit a monitoring report. If the Control Authority has chosen this alternative and is collecting all the data that would ordinarily be required from the Industrial User (e.g., flow data, production data) and at a frequency that would be expected of the user if it were conducting self-monitoring, the Control Authority may waive the requirement that the Industrial User report continuing compliance [40 CFR 403.12(g)].

In such a case, the Control Authority should explicitly state in the permit that periodic monitoring and reporting requirements are waived but still include a list of all applicable effluent limits in the permit. Even if the Control Authority has decided to waive an Industrial User's continued compliance reporting requirements, the Industrial User is still required to submit documentation required by the Control Authority to determine compliance with any BMP or pollution prevention alternatives.

A list of all pretreatment reporting requirements outlined in 40 CFR Part 403 is described in detail in Table 7-4. The permit writer should review this table and include applicable reporting requirements in each permit. These reporting requirements can be placed in the permit together with any additional local reporting conditions. Some examples of actual permit reporting conditions are provided in Table 7-5.

The Control Authority must require appropriate reporting from Industrial Users. When drafting an Industrial User's reporting requirements, the permit should contain the following information in sufficient descriptive detail:

- *What* types of information are to be contained in each report (e.g., analytical data, flow data, or production data)
- *When* each report is to be submitted to the Control Authority (specifying the dates and frequency for submission)
- *Who* is responsible for signing and certifying the reports (e.g., an authorized corporate official)
- *Where* the reports are to be sent, including the Control Authority's address and, if appropriate, the name of the person responsible for receiving each report
- *How* the reports can be submitted to the Control Authority (e.g., electronic versus hardcopy submittals)

TABLE 7-4
INDUSTRIAL USER REPORTING REQUIREMENTS

Required report and citation	Report due date	Purpose of report	Information required
Baseline Monitoring Report (BMR) [40 CFR 403.12(b)(1-7)]	Within 180 days of effective date of the regulation or an administrative decision on category determination	• To provide baseline Information on industrial facility to Control Authority • To determine wastewater discharge sampling points • To determine compliance status with categorical Pretreatment Standards	• Identifying information about the facility (name, address, and so on) • List of all environmental control permits issued to the facility • Description of operations • Flow measurements of wastewater discharge to the POTW • Nature and concentration of pollutants discharged to the POTW • Certification of compliance status with categorical Pretreatment Standards • Compliance scheduled to attain compliance • Certification of validity of Information provided
Compliance Schedule Progress Reports [40 CFR 403.12 (c)(1-3)]	Within 14 days of each milestone date on the compliance schedule; at least every 9 months	• To track progress of the industrial facility through the duration of a compliance schedule	• Compliance with appropriate increment of compliance schedule • Reasons for any noncompliance • Actions taken to return to the approved schedule
90-Day Compliance Report [40 CFR 403.12(d)]	Within 90 days of the date for final compliance with applicable categorical Pretreatment Standard; for new sources, the compliance report is due within 90 days following commencement of wastewater discharge to the POTW	• To Notify Control Authority as to whether compliance with the applicable categorical Pretreatment Standards has been achieved • If facility is noncompliant, to specify how compliance will be achieved	• Nature and concentrated of all pollutants regulated by categorical Pretreatment Standards • Average and maximum daily flow for regulated manufacturing processes • Compliance status (is noncompliant, additional measures needed) • Certification of validity of information provided

TABLE 7-4 (Continued PART 2)

Required report and citation	Report due date	Purpose of report	Information required
Periodic Compliance Reports for CIUs (not including NSCIUs) [40 CFR 403.12(e)(1)]	Every June and December after the final compliance date (or after commencement of a discharge for new sources) unless the Control Authority increased frequency	• To provide the Control Authority with current information on the discharge of pollutants to the POTW from categorical industries	• Nature and concentration of all regulated pollutants • Average and maximum daily flows discharged to the POTW for the reporting period • Where mass-based units are used, a measure of the mass of pollutants discharged • For industries subject to the production-based standards, an actual average production rate for the reporting period • For industries subject to equivalent mass or concertation limits pursuant to 403.6(c), a reasonable measure of the long term production rate • Certification of the validity of the Information provided • Additional information as required by the Control Authority • For industries supject to BMPs, documentation required to determine compliance with the BMP
Periodic Compliance Reports for CIUs with Pollutant Not Present or Expected to be Present [40 CFR 403.12(e)(2)]	Every June and December after the final compliance date (or after commencement of a discharge for new sources) unless the Control Authority increased frequency	• To certify that a pollutant is not present or expected to be present at a facility	• For facilities that have been granted a waiver of monitoring for a pollutant that has been determined not to be present, a certification statement indicating that there has been no increase in the pollutant in the wastestream because of activities of the user (403.12(e)(2)(v))

TABLE 7-4 (Continued Part 3)

Required report and citation	Report due date	Purpose of report	Information required
Periodic Compliance Reports for CIUs with Reduced Monitoring Requirements [40 CFR 403.12(e)(3)]	Once every year, unless required more frequently in the categorical Pretreatment Standard or by the Control Authority	• To provide the Control Authority with current information on the discharge of pollutants to the POTW from categorical industries	• Nature and concentration of all regulated pollutants • Average and maximum daily flows discharged to the POTW for the reporting period • Where mass-based units are used, a measure of the mass of pollutants discharged • For industries subject to the production-based standards, an actual average production rate for the reporting period • For industries subject to equivalent mass or concertation limits pursuant to 403.6(c), a reasonable measure of the long term production rate • Certification of the validity of the Information provided • Additional information as required by the Control Authority • For industries subject to BMPs, documentation required to determine compliance with the BMP
Notice of Potential Problems, including Slug Loading [40 CFR 403.12(f)]	Notification of POTW immediately after occurance of slug load or any other discharge that couls cause problems to the POTW	• To alert the POTW of the potential hazards of the discharge	• None specified in General Pretreatment Regulations; other federal, state, and local regulations might address reporting requirements
Noncompliance Notification [40 CFR 403.12(g)(2)]	Notification of POTW within 24 hours of becoming aware of violation	• To alert the POTW of a known violation and potential problem that could occur	• Nature and magnitude of the violation; other information as determined by the POTW

TABLE 7-4 (Continued Part 4)

Required report and citation	Report due date	Purpose of report	Information required
Periodic Compliance Reports for Noncategorical Users [40 CFR 403.12(h)]	To be determined by the POTW, but at least once every 6 months	• To provide the POTW with current information on the discharge of pollutants to the POTW from Industrial Users not regulated by categorical standards	• Description of the nature, concentration, and flow of the pollutants required to be reported by the Control Authority • For industries subject to BMPs, documentation required to determine compliance with the BMP
Notification of Changed Discharge [40 CFR 403.12(j)]	Before any substantial changes in the volume or character of pollutants in the discharge	• To notify the POTW of anticipated changes in wastewater characteristics and flow that could affect the POTW	• All anticipated changes that could affect the character or volume of the discharge
Notification of Hazardous Waste Discharge [40 CFR 403.12(p)]	No later than 180 days after the discharge of the listed or characteristic hazardous waste	• To notify the POTW of the name of the hazardous waste and type of discharge (batch or continuous)	• The name of the hazardous waste, the EPA hazardous waste number, and the type of dis-charge • If the user discharge more than 100 kilograms of hazardous waste per calendar month, the user must also submit (to the extent such information is known) an identification of the hazardous constituents contained in the wastes and an estimation of the mass of constituents in the wast-estream expected to be dis-charged during the following 12
Notification of Changes Affecting Slug Discharge Potential [40 CFR 403.8(f)(2)(vi)]	Notification of POTW immediate-ly of any changes at the facility that affects its potential for a slug discharge	• To notify the POTW of changes that might require the facility to implement procedure to control slug discharges	• All changes that could affect the potential of a slug discharge

TABLE 7-4 (Continued Part 5)

Required report and citation	Report due date	Purpose of report	Information required
Annual Certification by NCSIUs [40 CFR 403.12(q)]	At least once a year	• To provide to the POTW a statement that the facility is in compliance with the definition of NCSIU	• The certification statement at 40 VFR 403.12(q) must be signed in accordance with the signatory requirements in 40 CFR 403.12(l)
Notification of Bypass [40 CFR 403.17]	If possible, at least 10 days before the date of the anticipated bypass. *OR* In the event of an unanticipated bypass, a verbal notification of a bypass that excecds applicipable Pretreatment Standards to the POTW within 24 hours from the time the Industrial User becomes aware of the bypass.	• To provide to the POTW a notice of the facility's intentional diversion or an unanticipated bypass of wastestreams from any portion of the facility's treatment facility	• A written submission must be provided within 5 days of the time the Industrial User becomes aware of the bypass. The written submission must contain a description of the bypass and its cause, the duration of the bypass (including exact dates and times), and if the bypass has not been corrected, the anticipated time it is expected to continue, and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

TABLE 7-5 EXAMPLE OF REPORTING REQUIREMENTS IN A PERMIT SECTION 2 – REPORTING REQUIREMENTS

A. Periodic Compliance Reports

1. In accordance with 40 CFR 403.12(e) and Section 99.15 of the Anytown General Ordinance, the permittee must, after the effective date of the permit, submit to the Director of Public Works reports indicating the nature and concentration of pollutants in the effluent that are limited by the standards specified in Part 1 of the permit. The reports are due by July 15 (for the reporting period of January through June) and January 15 (for the reporting period of July through December). The report must include a record of daily flow during each reporting period.
2. In cases where the Pretreatment Standard or local limits require compliance with a Best Management Practice (or pollution prevention alternative), the permittee is required to submit documentation required by the City or the Pretreatment Standard necessary to determine compliance.
3. If the permittee monitors any pollutant more frequently than required by this permit, in accordance with 40 CFR Part 136 or other EPA-approved methods, the results of such monitoring must be submitted with the applicable periodic report.
4. Where the permittee is subject to production-based standards, the permittee must submit the appropriate production data as specified below:

a) If the permittee is subject to equivalent mass or concentration limits, the production data reported must be a reasonable measure of the permittee’s long term production rate, or
b) If the permittee is subject to limits expressed only in terms of allowable pollutant discharge per unit of production, the production data reported must be the actual average production rate for the reporting period.

B. New or Changed Wastewater Reporting

1. The permittee must notify the City 90 days before the introduction of any new wastestreams or pollutants, or any substantial increase or decrease in the volume (i.e., 20 percent or greater variance from the monthly average flow) or characteristics of existing wastestreams discharged to Outfall 1, described above, or any other outfall of the permittee.
2. The permittee must notify the City immediately of any changes at its facility affecting the potential for a Slug Discharge.

C. Prevention of Spills and Accidental Discharges

1. The permittee must provide to the City, under Section 99.29, plans showing facilities and operating procedures to provide protection against spills or accidental discharges of prohibited or regulated materials as established by Section 99 of this permit. Such plans must include, but are not limited to the following:

a) Diking systems for containment
b) Alarm systems including test frequency of alarms
c) Employee education programs
d) Manhole sealing and repiping

2. The permittee must provide the spill prevention and accidental discharge control plans showing facilities and operating procedures to the City for review within 30 days of the effective date of the permit.
3. The City must review and approve plans before construction of any facilities.

D. Accidental Discharge Reporting

1. The permittee must notify the City immediately upon the occurrence of an accidental discharge, slug, spill, or any bypassing or overflow of untreated wastewater containing substances regulated by Section

99 of this permit to the sanitary sewer from the permittee's facility. The notification must be as specified in Section 99.02(7)(h).

E. Upset and Bypass Reporting

1. As specified in Section 99.04(8) and (9) of the ordinance, the permittee must notify the City within 24 hours of the first awareness of an upset or unanticipated bypass experienced by the permittee of its treatment that places it in a temporary state of noncompliance with wastewater discharge limitations contained in this permit or other limitations specified in Section 99. The following information must be submitted:

   a) A description of discharge and cause of noncompliance/bypass,

   b) The period of noncompliance including exact dates and times or, if not corrected, the anticipated time the noncompliance/bypass is expected to continue, and

   c) The steps being taken and planned to reduce, eliminate, and prevent reoccurrence of the noncompliance/bypass.

   d) A written report must be submitted, within 5 days of becoming aware of the upset or bypass, containing the above information.

2. The permittee must submit prior notice at least 10 days in advance of a planned bypass that could result in violation of applicable Pretreatment Standards.

F. Compliance Schedule Progress Reports

1. Not later than 14 days following each compliance schedule event in Part 3, Sections AI and A2, the permittee must issue a progress report to the City indicating whether the increment of progress has been met, and if not, the reason for the delay and the date the permittee expects to comply with the increment of progress.

G. Noncompliance Report

1. General Noncompliance

If the permittee's self-monitoring results indicate a discharge limit violation, the permittee must notify the City within 24 hours of becoming aware of the violation. The permittee must also repeat the sampling and analysis and submit the results of the repeat analysis to the City within 30 days after becoming aware of the violation.

H. All reports required by this section must be signed by a responsible corporate officer or other duly authorized representative.

I. All reports required by this permit must be submitted to the City at the following address:

City of Anytown Public Works Department
Attention: Pretreatment Coordinator
123 Walnut Street
Anytown, USA 11111

7.6.1 What Types of Information

Table 7-6 provides the permit writer with the types of information required for the Industrial User's periodic compliance reports. Those reporting requirements are generally included in either the standard conditions section or the reporting requirements section. Again, the format and language for that provision and any other reporting requirements are left to the Control Authority's discretion.

If a permit writer would like to incorporate a compliance schedule for meeting categorical Pretreatment Standards into a permit, the permit writer must ensure that the final compliance date does not exceed the compliance deadline established for the specific categorical pretreatment standard.

Further, if a CIU is subject to a compliance schedule contained in the permit, the permit writer must require the submission of periodic reports on the progress of compliance schedule activities. The Industrial User must submit those reports no later than 14 days after each milestone date and must describe the progress made, any delays experienced and the reasons for those delays, and steps taken to return to the schedule established.

If the permit writer has incorporated other compliance schedules (i.e., installation of sampling locations, development and implementation of slug discharge control plans), the permit writer should require submission of periodic progress reports of the compliance activities and a final compliance date.

Furthermore, the permit writer must impose any special reporting requirements on CIUs required by the specific categorical pretreatment regulations. A list of other special reporting requirements for specific CIUs are at Appendix G, Summary of Industrial Sectors with Categorical Pretreatment Standards and Requirements.

Finally, Table 7-4 lists additional pretreatment reporting requirements as outlined in 40 CFR Part 403. The table also includes what types of information are necessary for each of these reports. The permit writer should review Table 7-4 to ensure that any additional applicable reporting requirements, and the associated information required for each report, are incorporated into the permit.

TABLE 7-6 FUNDAMENTAL ELEMENTS OF AN INDUSTRIAL USER PERIODIC COMPLIANCE REPORT

• Basic Information. Name of Industrial User, address, and reporting period.

• Wastewater Pollutant Sampling and Analysis Data. Pollutants monitored, units in which pollutant results are recorded, the date(s) and time(s) samples were taken, sample collection method, the analytical methods used, and the concentration of pollutants.

- Where the Industrial User must comply with monthly average standards, calculation of the averages must be made and reported.

- Where mass limits are imposed, the report must include information on the mass/day discharges along with the supporting concentration and flow data.

• Production Data. For all other users subject to production-based standards, the user must submit the actual average production rate for the reporting period. For Industrial Users subject to equivalent mass or equivalent concentration limits calculated by the Control Authority, the report must contain a reasonable measure of the user's long-term production rate.

• Flow Data Reporting. Industrial Users subject to categorical Pretreatment Standards must submit average and daily maximum flow data. That data should include the flow rate, for each wastewater source, used in calculating the Industrial User's limits.

• Best Management Practices. Documentation of BMP or pollution-prevention activities and any required certifications (e.g., TTO certifications).

• Signature of Authorized Representative. A signed statement by an authorized representative that certifies the report's validity.

• 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. On the basis of 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."

If an Industrial User has certified to a particular condition of a categorical standard, a statement should be included acknowledging the continuing applicability of that certification. For example, metal finishers and electroplaters would provide the following certification statement to conform with alternatives for monitoring Total Toxic Organics (TTO) and their approved toxic organic management plan:

On the basis of my inquiry of the person or persons directly responsible for managing compliance with the Pretreatment Standard for Total Toxic Organics (TTO), I certify that, to the best of my knowledge and belief, no dumping of concentrated toxic organics into the wastewater has occurred since filing of the last semiannual compliance report. I further certify that this facility is implementing the toxic organic management plan submitted to the Control Authority.

If an Industrial User has been granted a monitoring waiver, the user must certify on each report that the facility's pollutants in the wastewater have not increased. The user must use the statement below:

On the basis of my inquiry of the person or persons directly responsible for managing compliance with the Pretreatment Standard for 40 CFR _________[specify applicable national Pretreatment Standard part(s)], I certify that, to the best of my knowledge and belief, there has been no increase in the level of ________ [list pollutant(s)] in the wastewaters because of the activities at the facility since filing of the last periodic report under 40 CFR 403.12(e)(1).

• Other Data
  - Identification of all occurrences of noncompliance
  - Explanation of violations and the corrective action(s) taken
  - Type of sample, sampling time and location, preservation used, and the person taking sample
  - Date the analysis was performed, the analytical methods used, and the person performing analysis
  - Industrial User limits
  - Telephone number of the contact person
  - Identification of any process or treatment changes

7.6.2 When Reports Should be Submitted

The permit writer must require Industrial Users subject to Pretreatment Standards to submit reports at a minimum of once every 6 months unless the Control Authority requires the Industrial User to submit reports more frequently, elects to collect all the information that would otherwise be supplied by the Industrial User [40 CFR 403.12(e) and (g)], classifies the CIU as an NSCIU, or reduces the CIU's reporting requirements.

Industrial users are required to comply with reporting periods as specified in the permit. A sample is required to be representative of the operations and wastewater discharged during that reporting period. The signatory certification and representative sample requirements apply to the entire period. A permittee cannot certify to something that has not occurred (e.g., an NSCIU certifying that it has been in compliance with the definition of NSCIU from the period of January through June 2009, but submitted the certification in May 2009).

To account for violations of a Pretreatment Standard, the user must notify the Control Authority within 24 hours of becoming aware of the violation and must resample and submit results within 30 days of becoming aware of the violation to ensure that the violation is not continuing [40 CFR 403.12(g)(2)]. Furthermore, the regulations at 40 CFR 403.12(g)(6) require an Industrial User subject to the reporting requirements at 40 CFR 403.12 (e) and (h) monitoring any regulated pollutants at the appropriate sampling location more frequently than required by the Control Authority, using the procedures contained at 40 CFR Part 136, to submit the results to the POTW.

Frequency for submission of self-monitoring reports should be established by the Control Authority on the basis of the need to evaluate an Industrial User's compliance status and such factors as the following:

- Industrial User's size in terms of significance of its flow to the POTW's treatment plant
- Nature of the Industrial User's discharge (i.e., the quantity and quality of the pollutants discharged)
- Industrial User's compliance history
- Industrial User's current self-monitoring frequency

In addition to including the reporting dates of periodic compliance reports and notification of exceedance requirements, the permit writer should also review the reporting requirements outlined in Table 7-4.

The permit writer should ensure that any additional applicable reporting requirements, and the associated due dates required for each report, are incorporated into the permit.

7.6.3 Who Signs the Reports

The permit should contain a provision that requires reports to be signed by a responsible corporate official. EPA's regulations require that reports by categorical users [40 CFR 403.12(l)] be signed by the following:

(a) By a responsible corporate officer, if the Industrial User submitting the reports is a corporation. For the purpose of this paragraph, a responsible corporate officer means

(i) a president, secretary, treasurer, or vice-president of the corporation in charge of a principal business function, or any other person who performs similar policy- or decision-making functions for the corporation, or;

(ii) the manager of one or more manufacturing, production, or operating facilities, provided, the manager is authorized to make management decisions that govern the regulated facility including having the explicit or implicit duty of making major capital investment recommendations, and initiate and direct other comprehensive measures to assure long-term environmental compliance with environmental laws and regulations; can ensure that the necessary systems are established or actions taken to gather complete and accurate information for control mechanism requirements; and where authority to sign documents has been assigned or delegated to the manager in accordance with corporate procedures.

(b) By a general partner or proprietor if the Industrial User submitting the reports is a partnership or sole proprietorship, respectively.

(c) The principal executive officer or director having responsibility for the overall operation of the discharging facility if the Industrial User submitting the reports is a federal, state, or local governmental entity, or their agents.

(d) By a duly authorized representative of the individual designated in paragraph (a), (b), or (c) of this section if

(i) the authorization is made in writing by the individual described in paragraph (a), (b), or (c);

(ii) the authorization specifies either an individual or a position having responsibility for the overall operation of the facility from which the Industrial Discharge originates, September 2012 8-25
such as the position of plant manager, operator of a well, or a well field superintendent, or a position of equivalent responsibility, or having overall responsibility for environmental matters for the company; and

(iii) the written authorization is submitted to the Control Authority

(e) If an authorization under paragraph (d) of this section is no longer accurate because a different individual or position has responsibility for the overall operation of the facility or overall responsibility for the environmental matters for the company, a new authorization satisfying the requirements of paragraph (d) of this section must be submitted to the Control Authority before submitting, or together with, any reports to be signed by an authorized representative.

7.6.4 Where Reports Are to be Sent

The reporting requirements section of the permit should also clearly identify where the Industrial User should submit all required reports by specifying the appropriate Control Authority department and address. An example of the format and language to require the submission of monitoring reports can be found in Table 7-5.

7.6.5 How Reports May be Submitted

The POTW can specify different methods that Industrial User must use when submitting its required reports. For example, the POTW can develop a template that all Industrial Users must use to submit their periodic compliance sampling results and certification statements. If the POTW requires the use of a specific reporting format, this requirement should be clearly established in the permit.

In addition, a POTW may require its Industrial Users to submit its required reports electronically. According to 40 CFR 403.8(g), before accepting electronic reports, the POTW must ensure that it has satisfied the requirements of 40 CFR Part 3 [Cross-Media Electronic Reporting Regulation (CROMERR)]. Under CROMERR, both new and existing electronic reporting systems require EPA approval. The regulation provides a framework for applying for, and obtaining such approval.

Topic 7 - Monitoring and Reporting Requirements Post Quiz

Define the Term

1. Any substantive or procedural requirement related to Pretreatment, other than a National Pretreatment Standard, imposed on an Industrial User.

2. Limitations on pollutant discharges to POTWs promulgated by the EPA in accordance with Section 307 of the Clean Water Act, that apply to specific process wastewater discharges of particular industrial categories.

3. A report submitted by categorical industrial users (CIUs) within 180 days after the effective date of an applicable categorical standard, or at least 90 days prior to commencement of discharge for new sources, which contains specific facility information.

4. Procedure for calculating alternative discharge limits at industrial facilities where a regulated wastestream from a categorical industrial user is combined with other wastestreams prior to treatment.

5. A stimulus that lingers or continues for a relatively long period of time, often one-tenth of the life span or more.

6. For purposes of applying the combined wastestream formula, a wastestream from an industrial process that is regulated by a categorical standard.

7. A record of each person involved in the possession of a sample from the person who collects the sample to the person who analyzes the sample in the laboratory.

8. A limit based upon the relative strength of a pollutant in a wastestream, usually expressed in mg/l.

9. No user shall introduce into a POTW any pollutant(s) which cause pass through or interference.

10. A sample which is taken from a wastestream on a one-time basis with no regard to the flow of the wastestream and without consideration of time.

11. The intentional diversion of wastestreams from any portion of an Industrial User's treatment facility.

12. An industrial user subject to National categorical pretreatment standards.

13. A discharge of untreated wastewater from a combined sewer system at a point prior to the headworks of a publicly owned treatment works. CSOs generally occur during wet weather (rainfall or snowfall).

14. The Director in an NPDES State with an approved State Pretreatment Program and the appropriate EPA Regional Administrator in a non-NPDES State or State without an approved pretreatment program.

15. The reduction of the amount of pollutants, the elimination of pollutants, or the alteration of the nature of pollutant properties in wastewater prior to or in lieu of discharging or otherwise introducing such pollutants into a POTW.

16. Sample composed of two or more discrete samples. The aggregate sample will reflect the average water quality covering the compositing or sample period.

17. Unregulated and dilute wastestreams (not regulated by categorical standards).

18. A source of indirect discharge.

19. Any pollutant that is neither a toxic pollutant nor a conventional pollutant (e.g., manganese, ammonia, etc.)

20. Water used for cooling which does not come into direct contact with any raw material, intermediate product, waste product, or finished product. The only pollutant contributed from the discharge is heat.

Topic 8 - Pretreatment and Wastewater Sampling Overview

Topic 8 - Section Focus: You will learn the basics of the pretreatment program's wastewater sampling, chain-of-custody and related procedures. At the end of this section, you will be able to understand and describe Clean Water Act's rule concerning pretreatment/local limit/special sampling requirements. Adherence to proper sample collection and handling protocols, 40 CFR Part 136 approved analytical methodologies, and record-keeping requirements can be verified through review of field measurement records, chain of custodies, and lab reports. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 8 – Scope/Background: To ensure defensibility of sampling data, Control Authorities should develop and implement standard operating procedures and policies detailing sample collection and handling protocols in accordance with 40 CFR Part 136.Field measurement records may require information regarding sample location, condition of and programmed settings for sampling equipment, wastewater meter readings, and information for such parameters as pH and temperature which require analysis in the field.

Water Sample Station commonly found at most wastewater treatment plants for Local Limits or Process Control or Special Sampling. This tap will allow the operator to obtain Grab Samples for pH, Temperature, COD, Bacterial, ORP, OUP, Organics and Inorganic field parameters. We will cover sampling and pH in greater detail.

8.1 Appropriate Sampling Frequencies

The General Pretreatment Regulations require Control Authorities to monitor each SIU at least annually and each SIU to self-monitor semi-annually. As with inspections, the Control Authority should assess site-specific issues, such as SIU effluent variability, impact of this effluent on the POTW, and the SIU's compliance history to determine appropriate sampling frequencies (i.e., if more frequent monitoring is necessary).

For more detailed information on sampling frequencies, consult the EPA's 2017 *Industrial User Inspection and Sampling Manual for POTWs*.

Parameter	Sample type	Container	Preservative	Holding time
pH	Grab	Polyethylene or Glass	N/A	analyze immediately 15 minutes
BOD	Composite	Polyethylene or Glass	chilled to 4°C	48 hours
TSS	Composite	Polyethylene or Glass	chilled to 4°C	7 days
NH 3 as N	Composite	Polyethylene or Glass	chilled to 4°C, H2 SO_4 to pH<2	28 days
Oil and Grease	Grab	Glass	chilled to 4°C, HCl or H_2SO_4 to pH<2	28 days
Cyanide, total	Grab	Polyethylene or Glass	chilled to 4°C, NaOH to a pH >12, and 0.6g of ascorbic acid if residual chlorine is present	14 days
Metals (total) excl. Cr^{+6} B, and Hg	Composite	Polyethylene or Glass	HNO3 to pH<2	6 months
624 (volatiles organics)	Grab	Amber glass, w/ Teflon septum lid and zero headspace	chilled to 4°C (additional laboratory preservation required)	7 or 14 days, depending on specific organic
625 (semi-volatile organics)	Composite	Amber glass w/ Teflon lined lid	chilled to 4°C (additional laboratory preservation required)	7 days for sample prep; 40 days for extract

Pretreatment Sampling

Sampling is the most appropriate method for verifying compliance with pretreatment standards. Monitoring location(s) are designated by the Control Authority and must be such that compliance with permitted discharge limits can be determined. Where possible, the Control Authority should not designate monitoring locations that are confined spaces or difficult to access or difficult to place automated sampling equipment.

Monitoring locations should:

- be appropriate for waste stream conditions;
- be representative of the discharge;
- have no bypass capabilities; and
- allow for unrestricted access at all times.

Control Authorities should measure flow to allow for collection of flow-proportioned composite samples, which are required, unless flow-proportional sampling is not feasible. Flow-proportional composite samples are preferred over time composite samples particularly where the monitored discharge is intermittent or variable.

Desired analyses dictate the preparation protocols, equipment, and collection bottles to be used to avoid contamination of samples or loss of pollutants through improper collection. Sampling for such pollutants as pH, cyanide, oil and grease, flashpoint, and volatile organic compounds require manual collection of grab samples.

Similar to composite samples, grab samples must be representative of the monitored discharge and are to be collected from actively mixed holding tanks or flowing wastestreams. Fluctuations in flow or the nature of the discharge may require collection of and hand-composting of more than one grab sample to accurately assess compliance.

To ensure defensibility of data, Control Authorities should develop and implement standard operating procedures and policies detailing sample collection and handling protocols in accordance with 40 CFR Part 136.

Adherence to proper sample collection and handling protocols, 40 CFR Part 136 approved analytical methodologies, and record-keeping requirements [40 CFR §403.12(o)(1)] can be verified through review of field measurement records, chain of custodies, and lab reports. Field measurement records may require information regarding sample location, condition of and programmed settings for sampling equipment, wastewater meter readings, and information for such parameters as pH and temperature which require analysis in the field.

Chain of custody forms serve as a link between field personnel and the laboratory and contain information regarding sample matrix, type, and handling. Lab reports should contain the minimum information specified in 40 CFR §403.12(o)(1)(ii-iv) as well as any additional information necessary to demonstrate compliance with 40 CFR Part 136 requirements (e.g., analytical methodology, sample preparation date and time, and time of analysis).

Use of standardized forms which prompt recording of information necessary for demonstrating compliance with applicable requirements will aid in ensuring it can be used as admissible evidence in enforcement proceedings or in judicial actions.

Compliance Sampling Evaluation

Wastewater sampling/analysis is an integral part of the National Pollutant Discharge Elimination System (NPDES) Compliance Monitoring Program. NPDES permits contain specific and legally enforceable effluent limitations and monitoring requirements.

Objectives and Requirements

When evaluating the permittee sampling program, the inspector should:

- Verify that the permittee's sampling program complies with the permit.
- Verify that the permittee's sampling program complies with:
  – Title 40 of the *Code of Federal Regulations* (CFR), sections 136.1 to 136.6 and Appendices A, B, and C (Guidelines for Establishing Test Procedures for the Analysis of Pollutants) for wastewater samples; and 40 CFR Part 503.
- Document potential violations to support enforcement action.

In addition, specific objectives of the sampling conducted by inspectors include the following:

- Verify compliance with effluent limitations.
- Verify accuracy of reports and program self-monitoring.
- Support enforcement action.
- Support permit development reissuance and/or revision.
- Determine the quantity and quality of effluent.

Sampling, analysis, preservation technique, sample holding time, and sample container requirements are provided under 40 CFR Part 136 as authorized by section 304(h) of the Clean Water Act (CWA). For all NPDES permittees the inspector should perform a review of sampling procedures and quality control measures the facility uses to ensure the integrity of sample data.

To evaluate sampling procedures, assess the following eight areas:

- Sample site locations
- Sample collection techniques
- Field measurements
- Sample labeling (including locations) and documentation
- Sample preservation and holding time
- Transfer of custody and shipment of samples
- Quality control
- Data handling and reporting

Types of Samples *(Credit USEPA)*

General
There are four types of routine samples that are collected by the POTW's Sampling Section: grab, time proportional composites, flow proportional composites, and hand composites. The sampling method used depends largely on the types of analyses to be run, and the nature of the wastestream being sampled. Each sampling method is described in this section.

Most POTW's will define the sampling methods which must be used by industrial users (IUs) to obtain representative samples to show compliance with their permits:
Example

(1) A grab sample is an individual sample collected in less than 15 minutes without regard for flow or time of day. pH, cyanide, oil and grease, sulfide, and volatile organics must be collected as grab samples.

(2) 24-hour flow proportional composite samples where feasible. The POTW may waive this requirement if the IU demonstrates that this method is not feasible. Samples would then be taken by means of time proportional composite sampling methods, or by hand composite where the IU can demonstrate that this will provide a representative sample of the effluent being discharged.

The volume of sample to be collected by any of these methods is dependent on the number and types of analyses that must be performed.

Grab Samples
Grab samples are individual samples collected in less than 15 minutes without regard to flow or time of day. Grab samples are normally taken manually, but can be pumped. Oil and grease samples and purgeable organics are exceptions and must be taken manually.

The collection of a grab sample is appropriate when a sample is needed to:

- Represent an effluent that does not discharge on a continuous basis.
- Provide information about instantaneous concentrations of pollutants at a specific time.
- Allow collection of a variable sample volume.
- Corroborate composite samples.
- Monitor parameters not amenable to compositing (e.g., pH, temperature, dissolved oxygen, chlorine, purgeable organics, oil and grease, coliform bacteria, and others specified by the NPDES permit, which may include phenols, sulfites, and hexavalent chromium).

Grab Sample

A sample which is taken from a water or wastestream on a one-time basis with no regard to the flow of the water or wastestream and without consideration of time. A single grab sample should be taken over a period of time not to exceed 15 minutes.

EPA Sample Identification Methods

Identify each sample accurately and completely. Use labels or tags to identify the samples that are moisture-resistant and able to withstand field conditions. If moisture-resistant labels are not available, place a piece of tape over each label to prevent water damage. Use a waterproof pen to complete the labels or tags. A numbered label or tag associated with a field sample data sheet containing detailed information on the sample is preferable to using only a label or tag for information.

The information for each sample should include the following:

- Facility name/location
- Sample site location
- Sample number
- Name of sample collector
- Date and time of collection
- Indication of grab or composite sample with appropriate time and volume information
- Identification of parameter to be analyzed
- If the sample is preserved and, if so, the preservative used

Various Composite Sampling Techniques (Credit EPA)

The four primary methods of composite sample collection are time compositing, flow proportion compositing, sequential compositing, and continuous compositing. Table 5-1 lists the advantages and disadvantages of these methods. The permit may specify which type of composite sample to use. Composite samples are collected either manually by combining multiple grab samples or by using automatic sampling equipment. Inspectors should consider variability in wastestream flow rate, parameter concentrations and the approved EPA methods when choosing compositing methods, sampling equipment (tubing and containers), and quality assurance procedures. The compositing methods are as follows:

• **Time Composite Sample**: This method requires discrete sample aliquots collected in one container at constant time intervals. This method is appropriate when the flow of the sampled stream is constant (flow rate does not vary more than ±10 percent of the average flow rate) or when flow monitoring equipment is not available.

• **Flow-Proportional Composite Sample**—in one method, a constant sample volume is collected at varying time intervals proportional to stream flow (e.g., 200 milliliters sample collected for every 5,000 gallons of flow). In the other method (which has two variations, see Table 5-1), the sample is collected by increasing the volume of each aliquot as the flow increases, while maintaining a constant time interval between the aliquots.

• **Sequential Composite Sample**—this method requires discrete samples collected in individual containers at constant time intervals or discharge increments; for example, samples collected every 15 minutes, composited into separate containers each hour. The discrete samples can then be manually flow-proportioned to form the composite sample. Alternatively, a constant sample volume is collected at constant discharge volume increments measured with a flow totalizer.

• **Continuous Composite Sample**—collect this sample continuously from the wastestream. The sample may be constant volume, or the volume may vary in proportion to the flow rate of the wastestream.

Influent Sample Collection
Document and take influent samples at points of high turbulence flow to ensure good mixing. In some instances, the most desirable location may not be accessible. Ensure sampling points are located prior to any internal facility return lines, and sampling equipment should be placed so that it does not interfere with flow measuring devices. The preferred sampling points for raw wastewater are at the most downstream location from the collection lines, but prior to preliminary treatment:

- Waste flowing from the last process in a manufacturing operation, for an industrial user.
- Pump wet well (if turbulent).
- Upstream collection lines, tank, or distribution box following pumping from the wet well or sump.
- Flume throat.
- Aerated grit chamber.
- Upstream siphon following the comminutor (in absence of grit chamber). If it is not possible to sample at a preferred point, choose an alternative location and document the basis for choosing that location.

Table 5-1. Compositing Methods			
Method	**Advantages**	**Disadvantages**	**Comments**
Time Composite			
Constant sample volume, constant time interval between samples.	Minimal manual effort; requires no flow measurement.	May lack representativeness for highly variable flows.	Widely used in both automatic and manual sampling.
Flow-Proportional Composite			
Constant sample volume, time interval between samples proportional to stream flow.	Minimal manual effort.	Requires accurate flow measurement reading equipment; manual compositing from flowchart.	Widely used in automatic as well as manual sampling.
Constant time interval between samples, sample volume proportional to total stream flow at time of sampling.	Minimal instrumentation.	Manual compositing from flowchart in absence of prior information on the ratio of minimum to maximum flow; chance of collecting too small or too large individual discrete samples for a given composite volume.	Used in automatic samplers and widely used as manual method.
Constant time interval between samples, sample volume proportional to total stream flow since last sample.	Minimal instrumentation.	Manual compositing from flow chart in absence of prior information on the ratio of minimum to maximum flow; chance of collecting too small or too large individual discrete samples for a given composite volume.	Not widely used in automatic samplers but may be done manually.
Sequential Composite			
Series of short period composites, constant time intervals between samples.	Useful if fluctuations occur and the time history is desired.	Requires manual compositing of aliquots based on flow.	Commonly used; however, manual compositing is labor intensive.
Series of short period composites, aliquots taken at constant discharge increments.	Useful if fluctuations occur and the time history is desired.	Requires flow totalizer; requires manual compositing of aliquots based on flow.	Manual compositing is labor intensive.
Continuous Composite			
Constant sample volume.	Minimal manual effort, requires no flow measurement highly variable flows.	Requires large sample capacity; may lack representativeness for highly variable flows.	Practical but not widely used.
Sample volume proportional to stream flow.	Minimal manual effort, most representative especially for highly variable sample volume, variable pumping capacity and power.	Requires accurate flow measurement equipment, large sample volume, variable pumping capacity, and power.	Not widely used.

Effluent Sample Collection

Collect effluent samples at the location specified in the NPDES permit. Occasionally, municipal plant permits may specify sampling prior to chlorination. For these plants, monitor all parameters at the upstream location except fecal coliforms, pH, and total residual chlorine. Collect wastewater for use in bioassays at the location specified in the facility's NPDES permit. Collect samples either manually (grab or composite) or with automatic samplers (continuous or composite).

The following general guidelines apply when taking samples:

- Take samples at a location specified in the NPDES permit and/or at a location selected to yield a representative sample.
- Use the sampling method (grab, composite, continuous) specified in the permit. Some parameters that must be collected as an individual grab sample are dissolved oxygen, total residual chlorine, oil and grease, coliform bacteria, purgeable organics, sulfides, cyanide, and total phenols. • Avoid collecting large nonhomogeneous particles and objects.
- Collect the sample facing upstream to avoid contamination.
- Do not rinse sample container with sample when collecting oil and grease and microbiological samples, but fill the container directly to within 2.5 to 5 cm from the top.
- Fill the container completely if the sample is to be analyzed for purgeable organics, oxygen, ammonia, hydrogen sulfide, free chlorine, pH, hardness, sulfite, ammonium, ferrous iron, acidity, or alkalinity.
- Collect sufficient volume to allow for quality assurance testing. (see EPA's website https://www.epa.gov/cwa-methods for a listing of all approved sampling methods. Each sampling method will indicate the required sampling equipment, sampling containers and sampling volume, but additional volumes may be necessary for quality assurance testing.

The following general guidelines apply when using automatic samplers:

- Collect samples where the wastewater is well mixed. Collect the sample near the center of the flow channel at 0.4 to 0.6 depth (mid-depth).
- Obtain a sufficient volume of sample to perform all required analyses plus any additional amount for quality control. Individual portions of a composite sample should be at least 100 milliliters to minimize sampler solids bias.
- For automatic samplers that use a peristaltic pump, obtain adequate flow rates in the sampler tubing to effectively transport the suspended solids. To avoid solids bias, the velocity of the wastewater in sample tubing should be at least 2 feet per second (fps) and the tubing diameter should be at least 0.25 inch.
- Time of sample collection begins when the last aliquot is dispensed into the composite sample container.

Sample Volume

The volume of sample collected depends on the type and number of analyses needed, as reflected in the parameters to be measured. Obtain the volume of the sample sufficient for all the required analyses plus an additional amount to provide for any split samples or repeat analyses.

EPA approved sampling methods provide a guide to sample volumes required for determining the constituents in wastewater (available at https://www.epa.gov/cwa-methods).

Consult the laboratory receiving the sample for any specific volume required. EPA's Methods for Chemical Analysis of Water and Wastes (EPA, 1979a) and Handbook for Sampling and Sample Preservation of Water and Wastewater (EPA, 1982), and the current EPA-approved edition of Standard Methods for the Examination of Water and Wastewater (American Public Health Association (APHA), American Water Works Association (AWWA), and Water Environment Federation (WEF), 2013) contain specific recommended minimum sample volumes for different pollutant parameters.

Sample Containers
The regulations at 40 CFR Part 136 describe required sample containers, sample preservation, and sample holding time. EPA approved sampling methods indicate appropriate sample containers for each analysis It is essential that the sample containers be made of chemically resistant material unaffected by the concentrations of the pollutants measured. In addition, sample containers must have a closure that will protect the sample from contamination. Collect wastewater samples for chemical analysis in plastic (polyethylene) containers. Exceptions to this general rule are oil and grease samples, pesticides, phenols, polychlorinated biphenyls (PCBs), and other organic pollutant samples.

Collect these in properly cleaned glass jars or bottles and seal. Collect bacteriological samples in properly sterilized plastic or glass containers. Collect samples that contain constituents that will oxidize when exposed to sunlight (such as iron cyanide complexes) in dark containers. Ensure sample containers are clean and uncontaminated. Check analytical procedures to determine if they specify container cleaning procedures. Use precleaned and sterilized disposable containers (e.g., polyethylene cubitainers).

If these are not used or if the analytical method does not specify procedures, use the following procedures for cleaning sample containers:

- Wash with hot water and detergent.
- Rinse with acid (e.g., nitric for metals).
- Rinse with tap water, then rinse three or more times with organic-free water.
- Rinse glass containers with an interference-free, redistilled solvent (such as acetone or methylene chloride for extractable organics.
- Dry in contaminant-free area.

EPA Sample Identification Procedures
Identify each sample accurately and completely. Use labels or tags to identify the samples that are moisture-resistant and able to withstand field conditions. If moisture-resistant labels are not available, place a piece of tape over each label to prevent water damage.

Use a waterproof pen to complete the labels or tags. A numbered label or tag associated with a field sample data sheet containing detailed information on the sample is preferable to using only a label or tag for information.

The information for each sample should include the following:

- Facility name/location
- Sample site location
- Sample number
- Name of sample collector
- Date and time of collection
- Indication of grab or composite sample with appropriate time and volume information
- Identification of parameter to be analyzed • If the sample is preserved and, if so, the preservative used

Wastewater Sample Preservation and Holding Time Introduction

In most cases, wastewater samples contain one or more unstable pollutants that require immediate (e.g., within 15 minutes) preservation and/or analysis. Provide appropriate chemical preservation before transferring samples to the laboratory. EPA approved sampling methods indicate appropriate sample preservation for each analysis (sampling methods are available at https://www.epa.gov/cwa-methods).

Procedures used to preserve samples include cooling, pH adjustment, and chemical treatment. For some parameters, such as cyanide and phenols, add preservatives to sample bottles prior to or immediately following sample collection.

For many samples, if preservatives are not appropriately used, bacteria can quickly degrade certain constituents (such as phenols and phosphorus). Other constituents may volatilize (such as volatile organics and sulfides) or may react to form different chemical species (hexavalent chromium, for example).

Proper preservation and holding times are essential to ensure sample integrity (see 40 CFR Part 136). Analysis of samples within one day ensures against error from sample deterioration. However, such prompt analysis is not feasible for composite samples in which portions may be stored for as long as 24 hours.

Where possible, provide sample preservation during compositing, usually by refrigeration to 6°C (or icing). If using an automatic sampler with ice, replace the ice as necessary to maintain low temperatures. This is a limitation of automatic samplers used during the summer when ice must be frequently replaced. Table II of 40 CFR 136.3(e) indicates maximum sample holding times. Times listed are the maximum holding times between sample collection and analysis that are allowed for the sample to be considered valid. Unless otherwise specified in the method, holding time limitations begin upon combination of the last aliquot in a sample. When use of an automatic sampler makes it impossible to preserve each aliquot, the chemical samples may be preserved by maintaining at 6°C until compositing and sample splitting is completed (40 CFR 136.3(e)).

Transfer and Custody of Samples
To ensure the validity of the permit compliance sampling data in court, written records must accurately trace the custody of each sample through all phases of the monitoring program (EPA Order 5360.1). The primary objective of this chain-of-custody is to create an accurate written record (see an example chain-of-custody form in Appendix M) that can be used to trace the possession and handling of the sample from the moment of its collection through its analysis and introduction as evidence.

The following procedures are appropriate for the transfer of custody and shipment of samples:

- Use sample seals to protect the sample's integrity from the time of collection to the time it is opened in the laboratory, including the time the sample is within an automatic sampling apparatus, thus the automatic sampler should be sealed on the outside. The seal should indicate the collector's name, the date and time of sample collection, and sample identification number. For automatic samplers, seals should indicate the sample time at which the apparatus began sampling, as the sample container is subsequently sealed in the apparatus.
- Pack samples properly to prevent breakage. Seal or lock the shipping container to readily detect any evidence of tampering. Use of tamper-proof evidence tape is recommended.
- Place samples on ice or synthetic ice substitute that will maintain sample temperature at 6°C throughout shipment.
- The responsibility for proper packaging, labeling, and transferring of possession of the sample lies with the inspector. Accompany every sample with a sample tag and a chain-of-custody record that

has been completed, signed, and dated. The chain-ofcustody record should include the names of sample collectors, sample identification numbers, date and time of sample collection, location of sample collection, and names and signatures of all persons handling the sample in the field and in the laboratory.

• The originator retains a copy of the chain of custody forms. Also, the originator must retain all receipts associated with the shipment.

• EPA Inspectors with the responsibility of working with hazardous materials that are placed in commerce (transporting/shipping) must have hazardous materials training as required by the Department of Transportation (see Appendix N).

• When transferring possession of samples, the transferee must sign and record the date and time on the chain-of-custody record (use the currently approved record). In general, custody transfers are made for each sample, although samples may be transferred as a group, if desired. For each sample being transferred, the transferee should list the sample and their name on the custody record. Each person who takes custody must fill in the appropriate section of the chain-of-custody record. Both the transferee and person who takes custody of the sample(s) must sign the custody record.

• Pack and ship samples in accordance with applicable International Air Transportation Association (IATA) and/or DOT regulations.

Quality Control

Conduct control checks during the actual sample collection to determine the performance of sample collection techniques. In general, the most common monitoring errors usually are improper sampling methodology, improper preservation, inadequate mixing during compositing and splitting, and excessive sample holding time. In addition, collect and analyze the following samples to check sample collection techniques:

Blanks

Trip blank

Trip blanks are vial(s) filled at the laboratory with deionized water. The blank(s) follows the same handling and transport procedures as the samples collected during the event. The blank(s) functions as a check on sample contamination originating from sample transport, shipping and from site conditions. Note: Expose the trip blank vial(s), to the same environmental conditions (light, temperature, etc.) of the sample vial(s) but do not open until it is time for analysis.

Field blank/field reagent blank

Field blanks are similar to trip blanks except they are prepared in the field with deionized water exactly as the sample(s) that are collected. Field blanks are used to check for analytical artifacts and/or background introduced by sampling and analytical procedures.

Temperature blank.

A temperature blank is a small sample bottle filled with distilled water that is placed in each cooler prior to shipment. Upon arrival at the laboratory the temperature of the sample bottle is measured to evaluate if samples were adequately cooled during sample shipment.

Equipment/rinsate blank

Collect an equipment/rinsate blank when using an automatic sampler or other non-dedicated equipment during the sampling process. The blank is a check of the equipment cleanliness. For automatic samplers, prepare blanks prior to collecting samples, by pumping deionized organic free water (rinsate) through the sampler and collecting the discharge purge water in a sample container for analysis for the constituents of concern.

Field Duplicate
Collect a field duplicate sample simultaneously from the same source at selected stations on a random timeframe by grab samples or from two sets of field equipment installed at the site. Duplicate samples check analytical precision as well as evaluate the “representativeness” of the sample aliquot.

Split Samples
Split samples are samples that have been divided into two containers for analysis by separate laboratories. These samples provide an excellent means of identifying discrepancies in the permittee’s analytical techniques and procedures. When filling split samples from a single composite jug, shake the composited sample well and half fill the EPA sample container, then shake the composite again and fill half of the permittee’s container. Repeat the procedure for each parameter collected. The laboratories performing the sample analyses should also use the following control measures:

Prep/Reagent Blank
A prep/reagent blank is a sample consisting of reagent(s), without the target analyte or sample matrix, introduced into the analytical procedure at the appropriate point and carried through all subsequent steps to determine the contribution of the reagents and to aid in identifying errors in the observed value that may result from the analytical steps.

Quality Control Sample
A quality control sample is an uncontaminated sample matrix spiked with known amounts of analytes from a source independent from the calibration standards. Use this sample to establish intra-laboratory or analyst specific precision and bias or to assess the performance of all or a portion of the measurements’ system.

Matrix Spike/Matrix Spike Duplicate (MS/MSD)
A matrix spike/matrix spike duplicate sample is three times the normal volume required for a specific chemical analysis to which a known quantity of analyte has been added prior to all sample preparation. The laboratory utilizes the MS/MSD samples as part of their Quality Assurance/Quality Control Program.

- Use a matrix spike to verify accuracy of the analytical procedures.
- A matrix spike duplicate is a duplicate of a matrix spike sample. It measures the precision of the analysis in terms of relative percent difference.

Table 5-2 indicates quality control procedures for field analyses and equipment. Quality control is discussed in greater detail in Chapter 7 EPA's NPDES

Collecting Procedure for Water/Wastewater Grab Samples

1. Lower dipper or mouth of the bottle into water just below surface. Note sampling time and any other relevant information to the previously applied sampling label.

2. Retrieve or move the collected sample to a clean processing area.

3. If a bottle was used to collect the sample, rinse the bottle 3 times to remove any contaminants.

4. Pour the sample into the required laboratory bottle.

5. You may need to filter the sample; this is true with some water and wastewater samples. Filtering (for ortho-P and NOx samples).

6. Bottles supplied by an independent laboratory often come pre-loaded with preservative. Otherwise, preservative can be added in the POTW's lab. Bringing bulk preservatives, often strong acids and bases, into the field is not practical.

7. Secure sample container caps tightly.

8. Place the sample containers in an iced cooler before storage.

Timed Composites
Timed samples are usually taken in instances where the intention is to characterize the wastes over a period of time without regard to flow, or where the flow is fairly constant.

Timed composite samples consist of a series of equal volume grab samples taken at regular intervals. A typical interval is 15 minutes, with a maximum sampling duration of 24 hours.

The sample volume and sampling interval need to be calculated, and calibrated, so as to not overfill the collection bottle.

Samplers are available which can hold 24 separate bottles, each of which can receive multiple samples. Samplers can also be fitted with a single composite bottle, typically having a 2.5-gallon capacity. They provide space around the bottle for ice to cool the sample.

Flow Proportional Composites
Flow proportional composite samples consist of: a series of grab samples whose volumes are equal in size, taken each time a specified amount of flow has been measured. For example, a flow measuring device sends readings to a controller which then sends a signal to the sampler every time 1,000 gallons of flow are recorded. A flow measuring device must be used in conjunction with the automatic sampler.

This sampling method is used for all sampling activities except for instances where grab samples are required or time proportional sampling is more expedient and can provide the same accuracy as flow proportional sampling (i.e., constant flow levels or level of contaminants).

Hand Compositing
When sampling a batch discharge tank, hand compositing can be done. If the tank contents are homogenous, and remain so by active mixing, a grab sample provides the same results as a flow proportional composite sample.

If one is not certain that the contents of a batch tank are homogenous, taking four or more discharge grab samples of equal volume at evenly spaced time intervals over the course of the discharge will produce a more representative sample.

For multiple batch discharges in a day, the results of the hand composites can be averaged, considering differences in the volume of the batches.

The results of one, or the proportional average of multiple batch discharges, are the equivalent of a 24-hour flow proportional sampling at a facility with a continuous discharge. The sampling data would be compared with the average daily categorical standards or local limits where applicable.

Pre-Sampling Procedures
To ensure acceptable analytical results, numerous steps must be followed before a sampling program can be initiated:

To ensure that sampling goes smoothly, a considerable amount of preparation is required.
(1) All sampling equipment shall be clean and be in good working order.
(2) Fully charge needed batteries and backups.
(3) Select approved sampling location or equivalent.
(4) Determine what analyses are needed. Be sure the method selected Is sensitive enough to provide results in the range of the permit limit.
(5) Order sample bottles if not enough are in stock.
(6) Label sample containers with available information.
(7) Pack extra sample containers and labels to replace any that break while sampling.
(8) Gather enough ice chests to hold all the samples with room for ice/ice packs.
(9) Prepare PPE and, if needed, traffic control and/or confined space entry equipment.
(10) Arrange for the additional staff required for traffic control or confined space entry.
(11) Prepare Chain of Custody forms.

Sampling Equipment Example
Most pretreatment programs have one or more dedicated vehicles. These are loaded with equipment that is routinely needed for sampling. This typically includes equipment for confined space entry (support frame, winch, harnesses, gas detector, blowers, etc.) traffic diversion (cones, reflective vests, flags, etc.), manhole cover removal, flow measurement, PPE, and, of course, sampling.

There are many types and brands of automatic composite samplers. Most use a battery for remote placement and power from an outlet when available. If more than a few grabs for pH and temperature are needed, probes linked to a local or remote data logger are used for “sampling”.

The equipment that is kept in the sampling vehicle is dependent on the types of sampling activities planned each week, while the equipment stored in the storeroom is for back-up needs and future sampling demands.

Each sampling vehicle should be equipped with at least one sampler and one flow meter more than is needed for the particular sampling period. For example, three scheduled flow proportionate sampling sites would require a vehicle to be equipped with four samplers and four flow meters.

At least one spare battery for each type of equipment taken into the field should also be placed in the sampling vehicle.

Auxiliary equipment, such as supports, harnesses, blowers, etc., to be carried in each vehicle will depend on the nature of the sampling location.

In order to keep the equipment in good working order, the equipment should be maintained, cleaned and inspected on a regular basis. Routine maintenance and cleaning procedures should be written into your standard operating procedures.

Sampling Equipment Maintenance - Example

Basic maintenance for samplers includes: periodic calibration and general equipment checking, and replacement of the internal desiccant and fuses. Routine cleaning or replacement of tubing and other parts should be done following the manufactures guidelines or according to your SOP.

Basic maintenance of the flow meters includes: periodic replacement of the internal desiccant, plotter paper, ribbon, fuses, and any broken re-roll spool assemblies. Note: Some flow meters have two tabs on the sides which are extremely thin and easily broken.

The NiCad and Gel Cell batteries need to be recharged on a regular basis. Any battery that reads less than 12.50 when checked should not be installed or left on any of the sampling equipment. At the battery charging station, areas are set aside for batteries that need to be charged and batteries already charged.

To prolong battery life, NiCad batteries should be fully discharged before recharging for a maximum of 24 hours, in accordance with the procedures described in the manufacturer's operations and maintenance manuals. Always bring a second set or back-up set of batteries with you.

It is important to note that charged NiCad batteries, if left unused for a long time, are nevertheless slowly discharging. Gel cell batteries are generally more stable. Voltage readings should be taken before the charged batteries are taken into the field to be sure that they still have a full charge.

When a sampler, flow meter, or ancillary equipment needs more specific repairs, the manufacturer representative should be contacted and arrangements made for repair or replacement of the equipment.

Compliance Sampling Evaluation

Wastewater sampling/analysis is an integral part of the National Pollutant Discharge Elimination System (NPDES) Compliance Monitoring Program. NPDES permits contain specific and legally enforceable effluent limitations and monitoring requirements.

Objectives and Requirements
When evaluating the permittee sampling program, the inspector should:

- Verify that the permittee's sampling program complies with the permit.
- Verify that the permittee's sampling program complies with:
  – Title 40 of the *Code of Federal Regulations* (CFR), sections 136.1 to 136.6 and Appendices A, B, and C (Guidelines for Establishing Test Procedures for the Analysis of Pollutants) for wastewater samples; and 40 CFR Part 503.
- Document potential violations to support enforcement action.

In addition, specific objectives of the sampling conducted by inspectors include the following:

- Verify compliance with effluent limitations.
- Verify accuracy of reports and program self-monitoring.
- Support enforcement action.
- Support permit development reissuance and/or revision.
- Determine the quantity and quality of effluent.

Sampling, analysis, preservation technique, sample holding time, and sample container requirements are provided under 40 CFR Part 136 as authorized by section 304(h) of the Clean Water Act (CWA). For all NPDES permittees the inspector should perform a review of sampling procedures and quality control measures the facility uses to ensure the integrity of sample data.
To evaluate sampling procedures, assess the following eight areas:

- Sample site locations
- Sample collection techniques
- Field measurements
- Sample labeling (including locations) and documentation
- Sample preservation and holding time
- Transfer of custody and shipment of samples
- Quality control
- Data handling and reporting

Common Wastewater Sample Bottles

625/608, 1657, TTO/Organics, TPH/Oil/Grease,
Thin vials-TOCs, VOCs, 601/602 and 502.2
Be careful not to get air in the VOC/SVOC bottles.

NO_2/NO_3, Fluoride, Sulfide, Metals, BOD-TDS-TSS
Wide-mouth Sludge/Metals bottle

Laboratory

123 W. Main St
Sun City, Arizona 85541

LAB I.D. NUMBER

Sampler:

DATE: PAGE 1 OF 1

Company:
Department:
Address:
Contact:
Telephone:

Sample Identification	Date	Time	Matrix	Lab ID	Metals* See Attached	TSS	Lead/Copper	BOD/COD	Nitrate	Nitrate + Nitrite	TKN / Amonia	VOC / THM's	Semi Volital Organics (625)	Chloride		Cyanide	Floride	Surfactants (MBAS)	Tot. Coliform MPN	Fecal Coliform MPN-HPC	Organo-Phosphorus Pest. (8141)	Sulfate	EC Conductivity	Number/Containers

Project Name	Sample Receipt			RELINQUISHED BY:		RELINQUISHED BY:	
	No. Containers:			Signature:	Time:	Signature:	Time:
Project Number	Custody Seals:			Printed Name:	Date:	Printed Name:	Date:
	Received Intact:	Yes	No			Company	
Field Measurements:	Received Cold:	Yes	No	**SAMPLED RECEIVED BY:**		**SAMPLED RECEIVED BY:**	
pH:	Temperature:			Signature:	Time:	Signature:	Time:
Temp:	PRIORITY:			Printed Name:	Date:	Printed Name:	Date:
						Company	

Wastewater Sampling Information

Required Containers, Preservation Techniques, and Holding Times
40 CFR 136.3

Parameter number/name	Container 1	Preservation 2, 3	Maximum holding time 4
Table IA - Bacterial Tests			
1-4. Coliform, total, fecal, & E. coli	PA, G	Cool, <10 °C, 0.008% $Na_2S_2O_3$ 5	8 hours.22 23
5. Fecal streptococci	PA, G	Cool, <10 °C, 0.008% $Na_2S_2O_3$ 5	8 hours.22
6. Enterococci	PA, G	Cool, <10 °C, 0.008% $Na_2S_2O_3$ 5	8 hours.22
7. Salmonella	PA, G	Cool, <10 °C, 0.008% $Na_2S_2O_3$ 5	8 hours.22
Table IA - Aquatic Toxicity Tests			
8-11. Toxicity, acute & chronic	P, FP, G	Cool, ≤6 °C 16	36 hours.
Table IB - Inorganic Tests			
1. Acidity	P, FP, G	Cool, ≤6 °C 18	14 days.
2. Alkalinity	P, FP, G	Cool, ≤6 °C 18	14 days.
4. Ammonia	P, FP, G	Cool, ≤6 °C 18, H_2SO_4 to pH <2	28 days.
9. Biochemical oxygen dem&	P, FP, G	Cool, ≤6 °C 18	48 hours.
10. Boron	P, FP, or Quartz	HNO_3 to pH <2	6 months.
11. Bromide	P, FP, G	None required	28 days.
14. Biochemical oxygen dem &, carbonaceous	P, FP G	Cool, ≤6 °C 18	48 hours.
15. Chemical oxygen dem&	P, FP, G	Cool, ≤6 °C 18, H_2SO_4 to pH <2	28 days.
16. Chloride	P, FP, G	None required	28 days.
17. Chlorine, total residual	P, G	None required	Analyze within 15 minutes.
21. Color	P, FP, G	Cool, ≤6 °C 18	48 hours.
23-24. Cyanide, total or available (or CATC) & free	P, FP, G	Cool, ≤6 °C 18, NaOH to pH >10 5 6, reducing agent if oxidizer present	14 days.
25. Fluoride	P	None required	28 days.
27. Hardness	P, FP, G	HNO_3 or H_2SO_4 to pH <2	6 months.
28. Hydrogen ion (pH)	P, FP, G	None required	Analyze within 15 minutes.
31, 43. Kjeldahl & organic N	P, FP, G	Cool, ≤6 °C 18, H_2SO_4 to pH <2	28 days.
Table IB - Metals 7			
18. Chromium VI	P, FP, G	Cool, ≤6 °C 18, pH = 9.3-9.7 20	28 days.
35. Mercury (CVAA)	P, FP, G	HNO_3 to pH <2	28 days.
35. Mercury (CVAFS)	FP, G; & FP-lined cap 17	5 mL/L 12N HCl or 5 mL/L BrCl 17	90 days.17
Metals, except boron, chromium VI, & mercury 3, 5-8, 12, 13, 19, 20, 22, 26, 29, 30, 32-34, 36, 37, 45, 47, 51, 52, 58-60, 62, 63, 70-72, 74, 75.	P, FP, G	HNO_3 to pH <2, or at least 24 hours prior to analysis 19	6 months.
38. Nitrate	P, FP, G	Cool, ≤6 °C 18	48 hours.
39. Nitrate-nitrite	P, FP, G	Cool, ≤6 °C 18, H_2SO_4 to pH <2	28 days.
40. Nitrite	P, FP, G	Cool, ≤6 °C 18	48 hours.
41. Oil & grease	G	Cool to ≤6 °C 18, HCl or H_2SO_4 to pH <2	28 days.
42. Organic Carbon	P, FP, G	Cool to ≤6 °C 18, HCl, H_2SO_4, or H_3PO_4 to pH <2	28 days.
44. Orthophosphate	P, FP, G	Cool, to ≤6 °C 18 24	Filter within 15 minutes; Analyze within 48 hours.
46. Oxygen, Dissolved Probe	G, Bottle & top	None required	Analyze within 15 minutes.
47. Winkler	G, Bottle & top	Fix on site & store in dark	8 hours.
48. Phenols	G	Cool, ≤6 °C 18, H_2SO_4 to pH <2	28 days.
49. Phosphorus (elemental)	G	Cool, ≤6 °C 18	48 hours.

50. Phosphorus, total	P, FP, G	Cool, ≤6 °C 18, H_2SO_4 to pH <2	28 days.
53. Residue, total	P, FP, G	Cool, ≤6 °C 18	7 days.
54. Residue, Filterable (TDS)	P, FP, G	Cool, ≤6 °C 18	7 days.
55. Residue, Nonfilterable (TSS)	P, FP, G	Cool, ≤6 °C 18	7 days.
56. Residue, Settleable	P, FP, G	Cool, ≤6 °C 18	48 hours.
57. Residue, Volatile	P, FP, G	Cool, ≤6 °C 18	7 days.
61. Silica	P or Quartz	Cool, ≤6 °C 18	28 days.
64. Specific conductance	P, FP, G	Cool, ≤6 °C 18	28 days.
65. Sulfate	P, FP, G	Cool, ≤6 °C 18	28 days.
66. Sulfide	P, FP, G	Cool, ≤6 °C 18, add zinc acetate plus sodium hydroxide to pH >9	7 days.
67. Sulfite	P, FP, G	None required	Analyze within 15 minutes.
68. Surfactants	P, FP, G	Cool, ≤6 °C 18	48 hours.
69. Temperature	P, FP, G	None required	Analyze within 15 minutes.
73. Turbidity	P, FP, G	Cool, ≤6 °C 18	48 hours.

Table IC - Organic Tests 8

Purgeable Halocarbons 13, 18-20, 22, 24, 25, 27, 28, 34-37, 39-43, 45-47, 56, 76, 104, 105, 108-111, 113.	G, FP-lined septum	Cool, ≤6 °C 18, 0.008% Na2S2O3 5, HCl to pH 2 9	14 days.9
26. 2-Chloroethylvinyl ether	G, FP-lined septum	Cool, ≤6 °C 18, 0.008% $Na_2S_2O_3$ 5	14 days.
Purgeable aromatic hydrocarbons 9, 6, 57, 106.	G, FP-lined septum	Cool, ≤6 °C 18, 0.008% $Na_2S_2O_3$ 5, HCl to pH 2 9	14 days.
3, 4. Acrolein & acrylonitrile 10	G, FP-lined Septum	Cool, ≤6 °C 18, 0.008% $Na_2S_2O_3$, pH to 4-5 10	14 days.
Phenols 11 23, 30, 44, 49, 53, 77, 80, 81, 98, 100, 112.	G, FP-lined cap	Cool, ≤6 °C 18, 0.008% $Na_2S_2O_3$	7 days until extraction, 40 days after extraction.
7, 38. Benzidines 11 12	G, FP-lined cap	Cool, ≤6 °C 18, 0.008% $Na_2S_2O_3$ 5	7 days until extraction.13
Phthalate esters 11 14, 17, 48, 50-52.	G, FP-lined cap	Cool, ≤6 °C 18	7 days until extraction, 40 days after extraction.
82-84. Nitrosamines 11 14	G, FP-lined cap	Cool, ≤6 °C 18, store in dark, 0.008% $Na_2S_2O_3$ 5	7 days until extraction, 40 days after extraction.
88-94. PCBs 11	G, FP-lined cap	Cool, ≤6 °C 18	1 year until extraction, 1 year after extraction.
54, 55, 75, 79. Nitroaromatics & isophorone 11	G, FP-lined cap	Cool, ≤6 °C 18, store in dark, 0.008% $Na_2S_2O_3$ 5	7 days until extraction, 40 days after extraction.
Polynuclear aromatic hydrocarbons 11 1, 2, 5, 8-12, 32, 33, 58, 59, 74, 78, 99, 101.	G, FP-lined cap	Cool, ≤6 °C 18, store in dark, 0.008% $Na_2S_2O_3$ 5	7 days until extraction, 40 days after extraction.
15, 16, 21, 31, 87. Haloethers 11	G, FP-lined cap	Cool, ≤6 °C 18, 0.008% $Na_2S_2O_3$ 5	7 days until extraction, 40 days after extraction.
Chlorinated hydrocarbons 11 29, 35-37, 63-65, 73, 107.	G, FP-lined cap	Cool, ≤6 °C 18	7 days until extraction, 40 days after extraction.
CDDs/CDFs 11 60-62, 66-72, 85, 86, 95-97, 102, 103.	G	See footnote 11	See footnote 11.

Aqueous Samples: Field & Lab Preservation	G	Cool, ≤6 °C 18, 0.008% $Na_2S_2O_3$ 5, pH <9	1 year.
Solids & Mixed-Phase Samples: Field Preservation	G	Cool, ≤6 °C 18	7 days.
Tissue Samples: Field Preservation	G	Cool, ≤6 °C 18	24 hours.
Solids, Mixed-Phase, & Tissue Samples: Lab Preservation	G	Freeze, ≤−10 °C	1 year.
114-118. Alkylated phenols	G	Cool, <6 °C, H2SO4 to pH <2	28 days until extraction, 40 days after extraction.
119. Adsorbable Organic Halides (AOX)	G	Cool, <6 °C, 0.008% $Na_2S_2O_3$, HNO_3 to pH <2	Hold at least 3 days, but not more than 6 months.
120. Chlorinated Phenolics	G, FP-lined cap	Cool, <6 °C, 0.008% $Na_2S_2O_3$, H_2SO_4 to pH <2	30 days until acetylation, 30 days after acetylation.
Table ID - Pesticides Tests			
1-70. Pesticides 11	G, FP-lined cap	Cool, ≤6 °C 18, pH 5-9 15	7 days until extraction, 40 days after extraction.
Table IE - Radiological Tests			
1-5. Alpha, beta, & radium	P, FP, G	HNO_3 to pH <2	6 months.
Table IH - Bacterial Tests			
1, 2. Coliform, total, fecal	PA, G	Cool, <10 °C, 0.008% $Na_2S_2O_3$ 5	8 hours.22
3.E. coli	PA, G	Cool, <10 °C, 0.008% $Na_2S_2O_3$ 5	8 hours.22
4. Fecal streptococci	PA, G	Cool, <10 °C, 0.008% $Na_2S_2O_3$ 5	8 hours.22
5. Enterococci	PA, G	Cool, <10 °C, 0.008% $Na_2S_2O_3$ 5	8 hours.22
Table IH - Protozoan Tests			
6. Cryptosporidium	LDPE; field filtration	1-10 °C	96 hours.21
7. Giardia	LDPE; field filtration	1-10 °C	96 hours.21

Polyethylene (P) or glass (G). For microbiology, plastic sample containers must be made of sterilizable materials (polypropylene or other autoclavable plastic).

Sample preservation should be performed immediately upon sample collection. For composite chemical samples each aliquot should be preserved at the time of collection. When use of an automated sampler makes it impossible to preserve each aliquot, then chemical samples may be preserved by maintaining at 4 degrees C until compositing and sample splitting is completed.

When any sample is to be shipped by common carrier or sent through the United States Mails, it must comply with the Department of Transportation Hazardous Materials Regulations (49 CFR part 172). The person offering such material for transportation is responsible for ensuring such compliance. For the preservation requirements of Table II, the Office of Hazardous Materials, Materials Transportation Bureau, Department of Transportation has determined that the Hazardous Materials Regulations do not apply to the following materials: Hydrochloric acid (HCl) in water solutions at concentrations of 0.04% by weight or less (pH about 1.96 or greater); Nitric acid (HNO_3in water solutions at concentrations of 0.15% by weight or less (pH about 1.62 or greater); Sulfuric acid (H_2SO_4) in water solutions at concentrations of 0.35% by weight or less (pH about 1.15 or greater); and Sodium hydroxide (NaOH) in water solutions at concentrations of 0.080% by weight or less (pH about 12.30 or less).

Samples should be analyzed as soon as possible after collection. The times listed are the maximum times that samples may be held before analysis and still be considered valid. Samples may be held for longer periods only if the permittee, or monitoring laboratory, has data on file to show that for the specific types of samples under study, the analytes are stable for the longer time, and has received a variance from the Regional Administrator under Sec. 136.**3**(e). Some samples may not be stable for the maximum time period given in the table. A permittee, or monitoring laboratory, is obligated to hold the sample for a shorter time if knowledge exists to show that this is necessary to maintain sample stability. See Sec. 136.**3**(e) for details. The term ``analyze immediately'' usually means within 15 minutes or less of sample collection. Should only be used in the presence of residual chlorine.

Maximum holding time is 24 hours when sulfide is present. Optionally all samples may be tested with lead acetate paper before pH adjustments in order to determine if sulfide is present. If sulfide is present, it can be removed by the addition of cadmium nitrate powder until a negative spot test is obtained. The sample is filtered and then NaOH is added to pH 12.

Samples should be filtered immediately on-site before adding preservative for dissolved metals.

Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific compounds.

Sample receiving no pH adjustment must be analyzed within seven days of sampling.

The pH adjustment is not required if acrolein will not be measured. Samples for acrolein receiving no pH adjustment must be analyzed within **3** days of sampling.

When the extractable analytes of concern fall within a single chemical category, the specified preservative and maximum holding times should be observed for optimum safeguard of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4 deg. C, reducing residual chlorine with 0.008% sodium thiosulfate, storing in the dark, and adjusting the pH to 6-9; Samples preserved in this manner may be held for seven days before extraction and for forty days after extraction. Exceptions to this optional preservation and holding time procedure are noted in footnote 5 (re the requirement for thiosulfate reduction of residual chlorine), and footnotes 12, 13 (re the analysis of benzidine).

If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0<plus-minus>0.2 to prevent rearrangement to benzidine.

Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.

For the analysis of diphenylnitrosamine, add 0.008% $NA_2S_2O_3$ and adjust pH to 7-10 with NaOH within 24 hours of sampling.

The pH adjustment may be performed upon receipt at the laboratory and may be omitted if the samples are extracted within 72 hours of collection. For the analysis of aldrin, add 0.008% $NA_2S_2O_3$.

Sufficient ice should be placed with the samples in the shipping container to ensure that ice is still present when the samples arrive at the laboratory. However, even if ice is present when the samples arrive, it is necessary to immediately measure the temperature of the samples and confirm that the 4^0C temperature maximum has not been exceeded.

In the isolated cases where it can be documented that this holding temperature cannot be met, the permittee can be given the option of on-site testing or can request a variance. The request for a variance should include supportive data which show that the toxicity of the effluent samples is not reduced because of the increased holding temperature.

Metals Sampling *(Example Procedure)*

Metals sampling will encompass a variety of individual samples within a sample, i.e., nickel, zinc, silver and others. As a general rule, metals samples need to be collected as a composite and preserved with 1:1 nitric acid to pH < 2.

If ICP (inductively coupled plasma) laboratory analysis will be used, a 500 ml sample is sufficient. ICP is used for a general scan; if more stringent detection limits are needed then furnace analysis is used.

If additional analysis is required, i.e., furnace method analysis, collect a 2 liter bottle of sample (instead of the 500 ml sample) and preserve with nitric acid.

Ice is not necessary for preservation, but it won't jeopardize the sample, either.

PARAMETER	CONTAINER	PRESERVATIVE	MAX. HOLDING TIME
Metals	P	HNO_3 to pH < 2	6 months

Wastewater Treatment Plant Sampling *(Example Procedure)*

POTW samples are collected in accordance with the National Pollutant Discharge Elimination System (NPDES) permit which sets discharge limits for certain pollutants and specifies sampling frequencies and sample types.

Depending on the POTW, laboratory personnel, operators, or a combination of these are responsible to prepare sample bottles and trip blanks, program composite samplers, and collect grab samples. It is common to collect samples for operational parameters along with permit required samples.

Plant Sampling Procedure *(Example Procedure)*
Ideally, set up two samplers at the plant influent channel and two samplers at the plant effluent channel. Two samplers are used to provide sufficient sample quantity and to minimize the impact of a sampler failure. All sampling equipment must be prepared and cleaned as established in your POTW's SOP's procedures. Teflon hose is required. Sampling locations or sites are specified in each plant's NPDES permit.

Collect the following composite samples at both sites.

(1) **Metals Sample** - (one 2-liter plastic bottle)

Preserve with 1:1 nitric acid to a pH < 2. Store sample at 4°C.

(2) **Cyanide Sample** – (one 2-liter plastic bottle)

Collect the cyanide sample as a composite in accordance with NPDES permit. Check the sample for chlorine. If Cl_2 is present, use ascorbic acid to eliminate it. Add NaOH to a pH > 12. Store samples at 4°C.

(3) EPA Test Method 608 and 625 samples are informational samples only. These results are used for local limits data.

608 and 625 samples are collected as composite samples. From the well-mixed influent channel composite jug: Pour one 1-liter amber glass bottle of each sample (608, 625). Check samples for chlorine. At the effluent channel: Collect and pour one 4-liter amber glass bottle of each sample (608, 625). Check samples for chlorine. If Cl_2 is present in the samples, use sodium thiosulfate ($Na_2S_20_3$) to eliminate it. Store samples on ice at 4°C.

(4) **625/Phenols** are collected as a grab sample. Collect one 4-liter amber glass bottle at the effluent channel only. Check the sample for chlorine. If Cl_2 is present, use sodium thiosulfate ($Na_2S_20_3$) to eliminate it. Store sample at 4°C.

Bio-Solids Sampling *(Example Procedure)*

Bio-solids (dried sludge) samples are collected at POTWs.

Normally, bio-solid samples will be collected from the final storage area for dry sludge. The location of the dried bio-solids may vary based on the individual plants. Sampling frequency will be determined on an as needed basis and to comply with the EPA requirements.

Grab samples are useful for bio-solids. Care should be taken to avoid contamination. All samples are collected using a sterile plastic scoop in order to avoid any contamination.

The following is a list of samples to be collected:

PARAMETER	CONTAINER
Helminth Ova & Enteric Virus	1 Qt Plastic Bag (Ziploc)
Metals +	500 ml Plastic Bottle
Nitrogen (total)	4 oz Glass Bottle
TOC (Total Organic Carbon)	4 oz Glass Bottle
Fecal Coliform	500 ml Plastic Bottle

Sample Scheduling

An active file is maintained on each sampling location which contains historical data including past process discharge flow readings, water meter readings, sampling dates, and conditions of sampling site. A calendar of upcoming sampling events should be maintained.

River Sampling Activities *(Example Procedure)*

To judge the impact of a POTW's discharge to a river, it may be necessary to sample the river above and below the plant's outfall. When developing a sampling plan for river sampling, the following considerations must be observed:

(1) Sampling sites must meet the objectives of the program or study.

(2) At the sampling sites the river must be flowing freely and the sample must be as representative as possible of river flow at that site. Consideration of all safety factors must be observed.

(3) Samples must be collected midstream of the main channel at approximately two-thirds of the depth unless specific depths have been requested.

(4) All safety precautions must be observed during sampling which includes the use of harnesses, waterproof boots and other equipment.

Sewers *(Example Procedure)*

Sewer system and user rate sampling are conducted in manholes. General guidelines for selection of sampling locations include the following:

(1) Samples should be taken at points of high turbulent flow to ensure good mixing and prevent the deposition of solids.

(2) The sample location should be easily accessible and free of any major safety hazards.

(3) Sample lines should not be located where there is surface scum.

(4) If a flow study or a flow/proportional sampling event is required, make sure that the sewer pipe does not have a curve, a drop in the line or any obstructions. These would cause false flow readings.

Cleaning Automatic Samplers *(Example Procedure)*

Samplers, sample jars, grab beakers, and all other equipment used in collecting samples must be cleaned between their use at each site, to avoid the possibility of cross contamination. Latex or nitrile gloves should be worn to protect against infections and chemical burns. The following steps should be taken to ensure the proper cleaning of the sampling equipment.

Follow the manufactures recommended procedures for cleaning your automatic samplers. Clean composite jugs and caps separately from the samplers, following your labs SOP.

You may also want to read an EPA Operating Procedure [https://www.epa.gov/sites/default/files/2016-01/documents/field_equipment_cleaning_and_decontamination_at_fec206_af.r3_1.pdf].

Many state environmental departments have their own cleaning procedures for field samplers.

Cleaning often includes the following steps:

(1) Disassemble the sampler into its component parts.

(2) Add laboratory soap to a bucket and immerse the parts to be cleaned. Use a bottle brush to thoroughly scrub the inside and outside of parts, focusing on areas that sample comes in contact with.

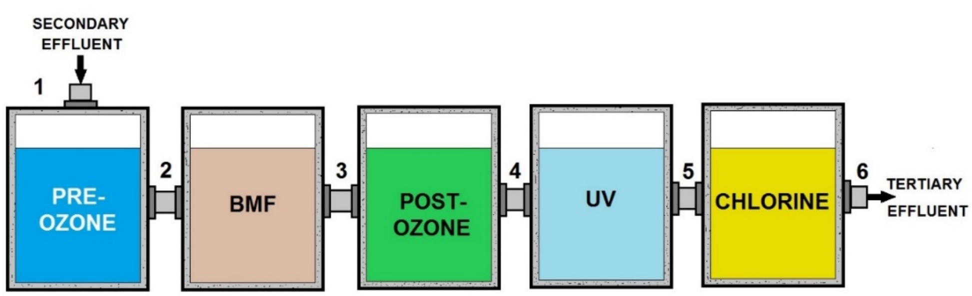
(3) Sometimes tubing (suction, peristaltic, or discharge) is so contaminated or worn that replacement is a better option than cleaning. Keep extra tubing in stock.

(4) A dilute acid is sometimes used to remove stubborn contaminants.

(5) A disinfectant is sometimes called for.

(6) Lab water is most commonly used for the final rinse before drying. Sometimes a solvent like acetone is used instead.

(7) Once dry, reassemble the sampler. Return it to your sampling vehicle or storage area. Leave the lid loose so moisture won't be trapped inside.



TERTIARY TREATMENT PROCESS SAMPLING POINTS

Selection of Sampling Site

In order to ensure the collection of valid samples, a representative sampling site must be selected. For industrial sampling, the sites are designated in the permit.

QA/QC Field Procedures for Plant Sampling *(Example Procedure)*

Duplicate Sampling Procedure

The purpose of Duplicate Samples is to check the laboratory's ability to reproduce analytical results. Duplicate Samples are to be collected using these steps:

1. Determine amount of sample needed. If a flow proportion sample is required, then base the amount of sample needed on the current flow reading. If a flow-proportion sample is not required, then use the predetermined amount for the sampling site.
2. Collect sample using a grab type sampler or a sampling head.
3. Measure the amount determined in Step 1 using a graduated cylinder or other accurate measuring device.
4. Pour measured sample into sample container that is not marked as the Duplicate Sample.
5. Measure same amount as in Step 1.
6. Pour second measured quantity into sample container marked for Duplicate Sample.
7. Process both samples using standard procedures and submit both samples to laboratory.

Split Sampling Procedure

The purpose of Split Samples is to check analytical procedures by having the samples analyzed by two different laboratories. Collect Split Samples following the procedure used for Duplicate Sampling. The only difference is that the Split Sample is sent to a different lab.

Trip Blank Procedure

The purpose of Trip Blanks is to determine if the purge bottles for the volatile organic samples have been adequately cleaned, and if sample contamination occurs between the time sample bottles leave the laboratory to the time that samples are returned to the lab.

Using a purge vile from the same source as the ones to be used for sampling, fill it with DI water in the laboratory. If purge bottles with a preservative are called for, use one of them for the trip blank. Note the time of Trip Blank sample collection on the COC form. Place the trip blank(s) in the ice chest with the purge bottles to be used for sampling. The Blank remains there for the sampling event and is processed with the other samples for testing.

Industrial Users - Permitted/Nonpermitted Sampling *(Example Procedure)*

The sampling points within an industry vary with each industry, depending on the nature of the process and location of pretreatment facilities. Therefore, exact locations must be identified on a case by case basis. However, the following general principles apply in all cases:

(1) SUOs should give permit writers the ability to require industries to install a sampling vault at a specified location. Depending on the specific site, a special sampling vault may or may not be needed.

(2) The sampling location should be easily accessible and relatively free of safety hazards.

(3) The specific location of all sampling points should be part of any permit. It is common to include a map and/or photos to help identify sampling locations.

(4) If a sampling location can no longer provide access to a representative sample, the permit needs to be modified to identify a location that works.

(5) When sampling a categorical process or pretreatment system effluent, there should be, if possible, no discharge present other than that from the regulated process. If other wastestreams are combined with the regulated wastestream prior to the sampling location, the combined wastestream formula will need to be utilized. The sampling crew must be aware of lower limits to correctly show analysis on chain of custody.

(6) When filling out chain of custody forms, be sure to specify a test method sensitive enough to provide concentration results below the limit.

(7) If mass limitations are to be applied, some means of determining process flow must be available.

(8) The local limit sampling location needs to be after all flows (industrial and domestic) have combined and before discharge to the public sewer.

Sample Volume -Type and Analyses

Typical sample volumes are required for various analyses. Each laboratory has developed their own standard volumes for routine analyses performed on industrial waste samples. If you are not getting sample bottles from a lab, be sure to ask what volumes they require. Typical volumes:

(1) BOD/COD/TSS (1000-2000 ml, plastic)
(2) Heavy metals (500-2000 ml, plastic)
(3) Cyanide (2000 ml, plastic)
(4) Oil and grease (1000 ml, level-one glass)

Selection and Preparation of Sample Containers

The selection of a sample container is based on the parameter to be measured and the volumetric needs of the lab. The primary variables are material, diameter of the opening, and volume. The inspector should be familiar with the type of sampling containers and preservatives that are needed.

It is essential that the sample containers be made of chemically resistant material, and do not affect the concentrations of the pollutants to be measured. In addition, sample containers should have a closure (i.e., leak proof/resistant, Teflon lined) that protects the sample from contamination and should be properly labeled before leaving the sampling site.

Common wastewater sample bottles

Radionuclides, VOCs, (Volatile Organic Compounds), TTHMs, (Total Trihalomethanes), Nitrate, Nitrite.

Most of these sample bottles will come with the preservative already inside the bottle.

Some bottles will come with a separate preservative (acid) for the field preservation.

Slowly add the acid or other preservative to the water sample; not water to the acid or preservative.

Sample Preservation

Wastewater usually contains one or more unstable pollutants that require immediate analysis or preservation until an analysis can be made. Sample preservation is needed for composite samples, for example, which may be stored for as long as 24 hours prior to transferring them to the laboratory. Recommended preservatives and holding times that should be used for specific pollutants are presented at the start of this Chapter.

Chain of Custody (COC)
Documentation of all pertinent data concerning the collection, preservation and transportation of samples is critical to the overall success of the Wastewater Sampling Program. If sampling is performed for the Pretreatment program, any sampling data may be used as evidence in court proceedings against a noncompliant industrial user. In this case, documentation becomes critical. The COC form is a legal document and is of major importance in a court hearing.

Specific procedures with regard to chain of custody are outlined below:

(1) The sampling crew takes a sufficient supply of prenumbered Industrial Waste Lab Reports, (custody forms) and sample containers into the field.

It is generally possible to fill out much of the form ahead of time, with the notable exceptions of the time of collection and the change in custody signatures.

a) TURN-AROUND TIME: Check box to indicate if results are needed on a rush basis or in standard turn-around time.
b) PROJECT #/NAME: The ID # or name assigned for the sampling event.
c) SITE ID #/NAME: For each sampling location.
d) DATE SAMPLED: From - Date sampling began. To - Date sample is pulled. If it is a grab sample, only the date the sample was taken will be entered with the other line crossed out.
e) COLLECTED: Date and Time. For a composite sample, the start, end, and total times are recorded.
f) MATRIX: Wastewater, DI water, etc.
g) SAMPLE TYPE: Grab or Composite (hand, flow, or time proportional).
h) SAMPLE BOTTLE: Material & Size
i) NUMBER OF CONTAINERS: Used for this sample.
j) PARAMETER: For example: Metals, Cyanide, O&G, VOC, etc. and,
k) TEST METHOD: Respectively: EPA 200.7, 4500-CN E, EPA 1664A, EPA 624, etc.
l) PRESERVATIVE: Codes for each preservative may be specified on the COC form.
m) NOTES to LAB: Includes any special notes to the lab, such as special analysis required of the sample, a letter code which is assigned to the entity being tested, the amount of flow if sample is flow proportional, grab sample pH and temperature, and/or actual sample temperature.
n) NOTES (Other): Should include the results of any field tests including pH and temperature.
o) COLLECTED BY: for the samplers initials and, if needed, the vehicle ID #.
p) RELINQUISHED BY: Signature w/Date & Time.
q) RECEIVED BY: Signature w/Date & Time.

(2) When a sample is taken the crew records the time of collection on the COC form.

Quality Assurance/Quality Control *(Example Procedure)*

Quality Assurance/Quality Control (QA/QC) measures taken by the sampling crew include equipment blanks, trip blanks, split samples and duplicate samples. Equipment blanks and trip blanks are routine QA/QC measures.

Split samples are taken for Local Limits sampling and when requested by an industry.

Split samples requested by an industry are analyzed by their lab at their expense.

Duplicate samples are run when requested by a Project Leader.

According to the EPA, the primary purpose of blanks is to trace sources of artificially introduced contamination. There are five types of blanks used to trace where contamination is introduced, three of which are used in the field and two are used the laboratory. https://www.epa.gov/sites/default/files/2015-06/documents/blanks.pdf

In addition, temperature blanks are sometimes used. Either laboratory staff or the sampling crew prepare the travel, trip, and/or temperature blanks needed for a sampling event.

Any contamination detected in the blanks would result from field exposure which could in turn affect collected samples.

Field Equipment (Rinsate) Blank Procedure *(Example Procedure)*

The purpose of Field Equipment Blanks, also known as Rinsate Blanks is to test the procedure for cleaning the sample measuring container to determine if cross contamination between sample sites has occurred. These Blanks are needed only at sites where flow-proportion samples are taken. Follow these steps when collecting a Field Equipment Blank (also see QA/QC check list example:

1. Collect Field Equipment Blank **AFTER** collecting a sample and **BEFORE** moving to the next sampling location.
2. Open a sealed bottle of High Purity Water.
3. After collecting a sample, triple rinse the sample measuring container, usually a graduated cylinder, using High Purity water.
4. Pour the High Purity Water into the sample measuring container that was just rinsed.
5. Pour the High Purity water from sample measuring device into sample bottles labeled for the Field Equipment Blanks.
6. Repeat Steps 3 through 5 until all Field Equipment Blank sample bottles have been filled.
7. Process samples using standard procedures and submit to laboratory.

An equipment blank is high purity water which has been collected in a composite sample bottle or a series of discrete bottles from an automatic sampler. Equipment blanks are used to evaluate the reliability of composite samples collected in the field. The data produced from the equipment blank indicates the performance of the sample collection system, which involves the cleaning of sampling equipment, and accessories, preservation techniques, and handling of samples. The objective is to demonstrate that the samples are not contaminated by inadequate cleaning of equipment, contaminated preservation additives or sample collection techniques, and to provide documented records on Quality Assurance Practices.

Procedures to be followed in collecting the equipment blanks are outlined below. (Also see QA/QC check list, example).

(1) The sampler is to be assembled completely in the manner determined by the parameters the crew will be sampling (i.e. if sampling for organics, Teflon suction tubing must be used at that site). The composite jar inside the sampler must always be rinsed out thoroughly with high purity water.

(2) Program the sampler to collect the proper amount of high purity water that is representative of the sample parameters that will be collected at that site. Grab samples are excluded. Pump high purity water through the strainer and intake tubing prior to filling the sampler bottle. Then, place the strainer into as many fresh, uncontaminated bottles of high purity water as needed to collect the necessary volume of sample.

(3) If the sampler is set up in the discrete mode, the crew must then transfer the collected samples into the field composite bottle and shake to mix thoroughly.

(4) Transfer the sample from the field composite bottle into its respective lab sample bottles. Test and preserve the samples as appropriate for the parameters being analyzed.

(5) Follow the chain of custody procedures outlined in SOP for turning the samples in to the laboratory. All paperwork must be completed at this time, and all bottles must be marked accordingly. Custody seals must be used. The crew must note the sampling activity in a logbook that is kept specifically for documenting preparation of equipment blanks and/or any other QA activities.

Sampling Techniques *(Example Procedure)*

General Guidelines
In general, the following guidelines should be observed in conducting sampling activities:

(1) Samples being collected must be representative of the wastestream being tested.

(2) Samples shall be collected in uncontaminated containers and preserved properly.

(3) Samples should be of sufficient volume for the required analyses.

(4) Samples should be stored in a manner which does not alter the properties of the sample prior to chain of custody transfer.

(5) Samples should be properly and completely identified by labeling them with the proper information.

(6) Sample lines should be as short as possible and the smallest practical diameter to facilitate purging, reduce lag time, and give adequate consideration to maximum transport velocity. Also, they should have sufficient strength to prevent structural failure.

(7) Sample lines should be pitched downward at least 10 percent to prevent settling or separation of solids contained by the sample.

(8) Samples should be delivered as quickly as possible to the laboratory.

Specific Techniques
Sampling techniques in addition to the above general guidelines must also recognize differences in sampling methodology, preservation, and analytical methods.

The following sections specify techniques that differ by pollutant group and discuss such factors as sampling methodology (e.g., composite, grab, etc.), type of container, preservation and holding time.

Sampling Techniques for Volatile Organics *(Example)*
Volatile organics are analyzed in accordance with EPA methods 601, 602, 603 and 624.

Due to the volatility of these compounds, only grab samples can be used. If a composite sample is needed, individual grab samples must be collected and composited in the laboratory prior to analysis.

The procedures that must be followed in taking these samples are outlined below.

NOTE: Gloves, clothing, face, and eye protection must be worn when handling volatile organics. In addition, the sampling crew must thoroughly clean those parts of the body that have been exposed to these materials.

(1) For each sampling date, the lab should also provide two additional bottles to be used as a backup in case of breakage. These sampling vials are only good for one week. If any are unused, they must be returned to the lab for disposal.

(2) The lab will provide one sample trip blank per sampling date. This bottle is to be kept on ice until the samples are submitted to the lab. At least one day prior to sampling, go to the lab and request the sample bottles (40 ml vials) for the specific sampling site, as indicated by the sampling plan. The laboratory will arrange to have the appropriate number of sample bottles prepared, based on the number of analyses to be performed. The sampling crew should make sure that all bottles are provided for these samples by the lab technicians.

(3) Collect the sample in a clean glass beaker. Test for chlorine with the Hach test kit. If there is any chlorine residual, neutralize the chlorine with sodium thiosulfate ($Na_2S_2O_3$) and retest for chlorine. Repeat until there is no chlorine residual. Make notes on chain of custody sheet if extra amounts of sodium thiosulfate are required for neutralization.

(4) Remove the vials from the ice. There will be two empty vials for the 601 sample and two vials with HCl for the 602. The HCl will already have been measured into the vials by the lab personnel.

(5) Fill the vial so that the sample is higher than the rim. Surface tension causes this bulge to exist. This is accomplished by pouring the sample from the beaker into the vial along the side of the vial to minimize the possibility of entrapping air in the sample. Do not rinse out or overfill the vials, this will wash out the preservative in the vial.

(6) Seal the vial so that no air bubbles are entrapped in it. Remember to put the Teflon side of the cap facing down onto the vial.

(7) To be sure there are no air bubbles, turn the vial upside down and tap it against the palm of the hand. Check to see if there are air bubbles along the sides or bottom of the vial. If there are bubbles, unseal the vial, top off the vial, and reseal. Check the vial again for the presence of bubbles.

(8) All samples must be maintained at 4°C from the time of collection until the time of extraction. Custody seals must be placed on all samples, and all paper work must be filled out properly.

(9) Return the sample bottles and QA/QC bottles to the laboratory the same day the sample is collected.

SOC Sub-Section

Common wastewater sampling bottles. SOC/VOC bottles are the smaller, thin bottles with the septum tops. Be careful not to get any air bubbles in the SOC/VOC bottles

SOC Introduction

Synthetic Organic Chemicals (SOCs) are organic (carbon based) chemicals that are less volatile than Volatile Organic Compounds (VOCs). SOCs are used as pesticides, defoliants, fuel additives and as ingredients for other organic compounds. They are all man made and do not naturally occur in the environment. Some of the more well-known SOCs are Atrazine, 2,4-D, Dioxin and Polychlorinated Biphenyls (PCBs).

SOCs most often enter the natural environment through application of pesticide (including runoff from areas where they are applied), as part of a legally discharged waste stream, improper or illegal waste disposal, accidental releases or as a byproduct of incineration. Some SOCs are very persistent in the environment, whether in soil or water.

SOCs are generally toxic and can have substantial health impacts from both acute (short-term) and chronic (long-term) exposure. Many are known carcinogens (cancer causing). EPA has set Maximum Contaminant Levels (MCL) for 30 SOCs under the Safe Drinking Water Act.

SDWA Act
The Safe Drinking Water Act requires that all water sources of all public water systems be periodically monitored for regulated SOCs. The monitoring frequency can be adjusted through a waiver if SOCs are not detected.

EPA established Maximum Contaminant Levels (MCL), Maximum Contaminant Level Goals (MCLG), monitoring requirements and best available technologies for removal for 65 chemical contaminants over a five year period as EPA gathered and analyzed occurrence and health effects data. This series of rules are known as the Chemical Phase Rules and they define regulations for three contaminant groups:

- Inorganic Chemicals (IOC),
- Synthetic Organic Chemicals (SOC), and
- Volatile Organic Chemicals (VOC).

The Chemical Phase rules provide public health protection through the reduction of chronic risks from:

- cancer;
- organ damage; and
- circulatory,
- nervous, and
- reproductive system disorders.

They also help to reduce the occurrence of Methemoglobinemia or "blue baby syndrome" from ingestion of elevated levels of nitrate or nitrite. All public water systems must monitor for Nitrate and Nitrite. Community water systems and Non-transient non-community water systems must also monitor for IOCs, SOCs, and VOCs.

This is a list of the organic chemicals—which include pesticides, industrial chemicals, and disinfection by-products—that are tested for in public water systems (those that provide water to the public), along with the maximum standard for the contaminant, and a brief description of the potential health effects associated with long-term consumption of elevated levels of the contaminants.

The federal standard for most contaminants is listed as a Maximum Contaminant Level (MCL), the lowest concentration at which that particular contaminant is believed to represent a potential health concern.

Unless otherwise noted, the MCL is expressed as parts per billion (ppb). Also, because of technological limitations or other factors, it is not possible to test for some contaminants in a reliable fashion. Instead, public water systems are required to use specific Treatment Techniques (TT) that are designed to remove these particular contaminants from the water.

In addition to the chemicals listed, monitoring is done for approximately 60 organic chemicals for which MCLs have not been established. If unacceptable levels are found of these “unregulated” contaminants—based on established state health standards and an assessment of the risks they pose—the response is the same as if an MCL has been exceeded: the public water system must notify those served by the system.

Volatile Organic Compounds (VOCs) Sub-Section

Definitions
Volatile Organic Compounds (VOCs) – "VOCs are groundwater contaminants of concern because of very large environmental releases, human toxicity, and a tendency for some compounds to persist in and migrate with groundwater to drinking-water supply well … In general, VOCs have high vapor pressures, low-to-medium water solubilities, and low molecular weights. Some VOCs may occur naturally in the environment, other compounds occur only as a result of manmade activities, and some compounds have both origins." - Zogorski and others, 2006

40 CFR 51.100(s) - Definition - Volatile organic compounds (VOC)
(s) "Volatile organic compounds (VOC)" means any compound of carbon, excluding carbon monoxide, carbon dioxide, carbonic acid, metallic carbides or carbonates, and ammonium carbonate, which participates in atmospheric photochemical reactions.

VOCs Explained

Volatile organic compounds (VOCs) are organic chemicals that have a high vapor pressure at ordinary, room-temperature conditions. Their high vapor pressure results from a low boiling point, which causes large numbers of molecules to evaporate or sublimate from the liquid or solid form of the compound and enter the surrounding air. An example is formaldehyde, with a boiling point of –19 °C (–2 °F), slowly exiting paint and getting into the air.

VOCs are numerous, varied, and ubiquitous. They include both human-made and naturally occurring chemical compounds. Most scent or odors are composed of VOC molecules. Industrial use of fossil fuels produces VOCs either directly as products (e.g., gasoline) or indirectly as byproducts (e.g., vehicle exhaust). Some VOCs are dangerous to human health or cause harm to the environment. Anthropogenic VOCs are regulated by law, especially indoors, where concentrations are the highest. Harmful VOCs are typically not acutely toxic, but instead have compounding long-term health effects. Because the concentrations are usually low and the symptoms slow to develop, research into VOCs and their effects is difficult.

Specific Sources of Select VOCs
Paints and Coatings
A major source of man-made VOCs are coatings, especially paints and protective coatings. Solvents are required to spread a protective or decorative film. Approximately 12 billion liters of paints are produced annually.

Typical paint solvents are aliphatic hydrocarbons, ethyl acetate, glycol ethers, and acetone. Motivated by cost, environmental concerns, and regulation, the paint and coating industries are increasingly shifting toward aqueous solvents.

Chlorofluorocarbons and Chlorocarbons
Chlorofluorocarbons, which are banned or highly regulated, were widely used cleaning products and refrigerants. Tetrachloroethene is used widely in dry cleaning and by industry. Industrial use of fossil fuels produces VOCs either directly as products (e.g., gasoline) or indirectly as byproducts (e.g., automobile exhaust).

Benzene
One common VOC that is a known human carcinogen is benzene, which is a chemical found in environmental tobacco smoke, stored fuels, and exhaust from cars in an attached garage. Benzene also has natural sources such as volcanoes and forest fires. It is frequently used to

make other chemicals in the production of plastics, resins, and synthetic fibers. Benzene evaporates into the air quickly and the vapor of benzene is heavier than air allowing the compound to sink into low-lying areas. Benzene has also been known to contaminate food and water and if digested can lead to vomiting, dizziness, sleepiness, rapid heartbeat, and at high levels, even death may occur.

Methylene Chloride
Methylene chloride is another VOC that is highly dangerous to human health. It can be found in adhesive removers and aerosol spray paints and the chemical has been proven to cause cancer in animals. In the human body, methylene chloride is converted to carbon monoxide and a person will suffer the same symptoms as exposure to carbon monoxide. If a product that contains methylene chloride needs to be used the best way to protect human health is to use the product outdoors. If it must be used indoors, proper ventilation is essential to keeping exposure levels down.

Perchloroethylene
Perchloroethylene is another VOC that has been linked to causing cancer in animals. It is also suspected to cause many of the breathing related symptoms of exposure to VOC's. Perchloroethylene is used mostly in dry cleaning. Studies show that people breathe in low levels of this VOC in homes where dry-cleaned clothes are stored and while wearing dry-cleaned clothing. While dry cleaners attempt to recapture perchlorothylene in the dry cleaning process to reuse it in an effort to save money, they can't recapture it all. To avoid exposure to perchlorothylene, if a strong chemical odor is coming from clothing when picked up from the dry cleaner, do not accept them and request that less of the chemical be used as well as a complete drying of the garments

MTBE
MTBE was used as an octane booster and oxygenated-additive. It was banned in the US around 2004 in order to limit further contamination of drinking water aquifers primarily from leaking underground gasoline storage tanks.

Formaldehyde
Many building materials such as paints, adhesives, wall boards, and ceiling tiles slowly emit formaldehyde, which irritates the mucous membranes and can make a person irritated and uncomfortable. Formaldehyde emissions from wood are in the range of 0.02 – 0.04 ppm. Relative humidity within an indoor environment can also affect the emissions of formaldehyde. High relative humidity and high temperatures allow more vaporization of formaldehyde from wood-materials.

Health Risks
Respiratory, allergic, or immune effects in infants or children are associated with man-made VOCs and other indoor or outdoor air pollutants. Some VOCs, such as styrene and limonene, can react with nitrogen oxides or with ozone to produce new oxidation products and secondary aerosols, which can cause sensory irritation symptoms. Unspecified VOCs are important in the creation of smog. VOCs are one category of hazardous air pollutants (HAPs) that are known or suspected to cause cancer, birth defects, and seriously impact the environment. Along with regulating air emissions, the EPA, through the Clean Water Act, regulates wastewater discharges of these, and other, pollutants from many categories of industries.

Health effects include:
Eye, nose, and throat irritation; headaches, loss of coordination, nausea; damage to liver, kidney, and central nervous system. Some organics can cause cancer in animals; some are suspected or known to cause cancer in humans. Key signs or symptoms associated with exposure to VOCs include conjunctival irritation, nose and throat discomfort, headache, allergic skin reaction, dyspnea, declines in serum cholinesterase levels, nausea, emesis, epistaxis, fatigue, dizziness.

The ability of organic chemicals to cause health effects varies greatly from those that are highly toxic, to those with no known health effects. As with other pollutants, the extent and nature of the health effect will depend on many factors including level of exposure and length of time exposed. Eye and respiratory tract irritation, headaches, dizziness, visual disorders, and memory impairment are among the immediate symptoms that some people have experienced soon after exposure to some organics. At present, not much is known about what health effects occur from the levels of organics usually found in homes. Many organic compounds are known to cause cancer in animals; some are suspected of causing, or are known to cause, cancer in humans.

Reducing Exposure
To reduce exposure to these toxins, one should buy products that contain Low-VOC's or No VOC's. Only the quantity which will soon be needed should be purchased, eliminating stockpiling of these chemicals. Use products with VOC's in well ventilated areas. When designing homes and buildings, design teams can implement the best possible ventilation plans, call for the best mechanical systems available, and design assemblies to reduce the amount of infiltration into the building. These methods will help improve indoor air quality, but by themselves they cannot keep a building from becoming an unhealthy place to breathe.

While proper building ventilation is a key component to improving indoor air quality, it cannot do the job on its own. As stated earlier, awareness is the key component to improving air quality, when choosing building materials, furnishings, and decorations. When architects and engineers implement best practices in ventilation and mechanical systems, the owner must maintain good air quality levels thereafter.

40 CFR 51.100(s) - Definition - Volatile organic compounds (VOC)

(1) This includes any such organic compound other than the following, which have been determined to have negligible photochemical reactivity:

- methane
- ethane
- methylene chloride (dichloromethane)
- 1,1,1-trichloroethane (methyl chloroform)
- 1,1,2-trichloro-1,2,2-trifluoroethane (CFC-113)
- trichlorofluoromethane (CFC-11)
- dichlorodifluoromethane (CFC-12)
- chlorodifluoromethane (HCFC-22)
- trifluoromethane (HFC-23)
- 1,2-dichloro 1,1,2,2-tetrafluoroethane (CFC-114)
- chloropentafluoroethane (CFC-115)
- 1,1,1-trifluoro 2,2-dichloroethane (HCFC-123)
- 1,1,1,2-tetrafluoroethane (HFC-134a)
- 1,1-dichloro 1-fluoroethane (HCFC-141b)
- 1-chloro 1,1-difluoroethane (HCFC-142b)
- 2-chloro-1,1,1,2-tetrafluoroethane (HCFC-124)
- pentafluoroethane (HFC-125)

- 1,1,2,2-tetrafluoroethane (HFC-134)
- 1,1,1-trifluoroethane (HFC-143a)
- 1,1-difluoroethane (HFC-152a)
- parachlorobenzotrifluoride (PCBTF)
- cyclic, branched, or linear completely methylated siloxanes
- acetone
- perchloroethylene (tetrachloroethylene)
- 3,3-dichloro-1,1,1,2,2-pentafluoropropane (HCFC-225ca)
- 1,3-dichloro-1,1,2,2,3-pentafluoropropane (HCFC-225cb)
- 1,1,1,2,3,4,4,5,5,5-decafluoropentane (HFC 43-10mee)
- difluoromethane (HFC-32)
- ethylfluoride (HFC-161)
- 1,1,1,3,3,3-hexafluoropropane (HFC-236fa)
- 1,1,2,2,3-pentafluoropropane (HFC-245ca)
- 1,1,2,3,3-pentafluoropropane (HFC-245ea)
- 1,1,1,2,3-pentafluoropropane (HFC-245eb)
- 1,1,1,3,3-pentafluoropropane (HFC-245fa)
- 1,1,1,2,3,3-hexafluoropropane (HFC-236ea)
- 1,1,1,3,3-pentafluorobutane (HFC-365mfc)
- chlorofluoromethane (HCFC-31)
- 1-chloro-1-fluoroethane (HCFC-151a)
- 1,2-dichloro-1,1,2-trifluoroethane (HCFC-123a)
- 1,1,1,2,2,3,3,4,4-nonafluoro-4-methoxy-butane ($C_4F_9OCH_3$ or HFE-7100)
- 2-(difluoromethoxymethyl)-1,1,1,2,3,3,3-heptafluoropropane ($(CF_3)_2CFCF_2OCH_3$)
- 1-ethoxy-1,1,2,2,3,3,4,4,4-nonafluorobutane ($C_4F_9OC_2H_5$ or HFE-7200)
- 2-(ethoxydifluoromethyl)-1,1,1,2,3,3,3-heptafluoropropane ($(CF_3)_2CFCF_2OC_2H_5$)
- methyl acetate
- 1,1,1,2,2,3,3-heptafluoro-3-methoxy-propane (n-$C_3F_7OCH_3$ or HFE-7000)
- 3-ethoxy-1,1,1,2,3,4,4,5,5,6,6,6-dodecafluoro-2-(trifluoromethyl) hexane (HFE-7500)
- 1,1,1,2,3,3,3-heptafluoropropane (HFC 227ea)
- methyl formate ($HCOOCH_3$)
- 1,1,1,2,2,3,4,5,5,5-decafluoro-3-methoxy-4-trifluoromethyl-pentane (HFE-7300)
- dimethyl carbonate
- propylene carbonate
- and perfluorocarbon compounds which fall into these classes:
    - (i) cyclic, branched, or linear, completely fluorinated alkanes,
    - (ii) cyclic, branched, or linear, completely fluorinated ethers with no unsaturations,
    - (iii) cyclic, branched, or linear, completely fluorinated tertiary amines with no unsaturations, and
    - (iv) sulfur containing perfluorocarbons with no unsaturations and with sulfur bonds only to carbon and fluorine.

(2) For purposes of determining compliance with emissions limits, VOC will be measured by the test methods in the approved State implementation plan (SIP) or 40 CFR Part 60, Appendix A, as applicable. Where such a method also measures compounds with negligible photochemical reactivity, these negligibly-reactive compounds may be excluded as VOC if the amount of such compounds is accurately quantified, and such exclusion is approved by the enforcement authority.

Toxic - Heavy Metals Sub-Section

Heavy metals, also known as trace metals, are one of the most persistent pollutants in wastewater. The discharge of high amounts of heavy metals into water bodies leads to several environmental and health impacts. The exposure of humans to heavy metals can occur through a variety of routes, which include inhalation as dust or fume, vaporization and ingestion through food and drink. Some negative impacts of heavy metals to aquatic ecosystems include death of aquatic life, algal blooms, habitat destruction from sedimentation, debris, increased water flow, other short and long term toxicity from chemical contaminants.

Abundant amounts of heavy metals present in soils cause reduction in quality and quantity of food preventing plants' growth, uptake of nutrients, physiological and metabolic processes. Severe effects on animals may include reduced growth and development, cancer, organ damage, nervous system damage, and in extreme cases, death. To help mitigate the negative impacts of heavy metals on the health of humans, animals and the environment, a variety of remediation processes exists. These remediation processes are broadly classified into chemical and biological, although the latter is advocated in recent years.

Biological remediation processes (microbial remediation and phytoremediation) are indicated to be very effective in the treatment of heavy metal pollutants in wastewater. Microbial remediation is the restoration of the environment and its quality using microorganisms, such as bacteria, fungi, protozoan and algae while phytoremediation is the use of plants to degrade or accumulate toxic metals, thereby leading to a reduction in the bioavailability of the contaminant in the soil or water.

Heavy metal concentrations from industrial wastewater pollution such as zinc, copper, nickel and chrome, has sparked major environmental compliance initiatives. For this purpose, government agencies established industry compliance standards for metal-contaminated wastewater discharge into municipal sewage treatment plants, and hazardous metal waste solids into landfills.

Industrial metal pollutants that include, but are not limited to:

- Aluminum
- Antimony (a metalloid)
- Arsenic is a metalloid
- Barium
- Beryllium
- Cadmium
- Copper
- Ferric (Iron / Iron Oxide)
- Hexavalent & Trivalent Chrome
- Lead
- Mercury - mercury poisoning
- Molybdenum
- Nickel / Electroless Nickel
- Osmium
- Selenium
- Silver
- Thallium
- Vanadium
- Zinc / Zinc Phosphate

Radioactive metals:

- Actinium
- Thorium
- Uranium
- Radium
- The transuraniums, such as plutonium, americium, etc.
- Polonium
- Radioactive isotopes of metallic elements not otherwise strongly toxic, e.g. cobalt-60 and strontium-90.

Aluminum

Aluminum has no biological role and its classification into toxic metals is controversial. Significant toxic effects and accumulation to tissues have been observed in renally impaired patients. However, individuals with healthy kidneys can be exposed to large amounts of aluminum with no ill effects. Thus, aluminum is not considered dangerous to persons with normal elimination capacity.

Trace Elements with Toxicity

- Chromium as hexavalent Cr(VI)
- Nickel – nickel salts are carcinogenic
- Copper – copper toxicity
- Zinc - zinc toxicity
- Iron – iron poisoning
- Fluorine-fluoride poisoning

Non-metals

Some heavy nonmetals may be erroneously called "metals", because they have some metallic properties.

- Selenium – a nonmetal; essential element
- Tellurium

Atomic Spectrometry

Atomic spectrometry converts each metal in the water sample to a particulate emission that can then be weighed. Extrapolations are made to determine each metal concentration in each water sample taken. The complicated analysis requires preserving the sample with acid, heating the sample to convert to a particulate emission and then identifying each metal and its weight.

A simple analogy is to capture the steam from a pot of water, separate every atom in the steam, identify each atom, weigh each atom and then apply these numbers back to the original volume of water contained in the pot. The result is an accurate picture of what is in the water.

Heavy Metals in Water

High heavy metals concentrations can be naturally occurring. Every geologic formation contains a certain amount of heavy metal. Mine operations extract and process these metals in areas with the highest concentrations. Water in these areas may have high metal concentrations due to the combination of naturally occurring deposits and mine waste.

Water samples are usually taken randomly within a contaminated area and offsite to identify the source of contamination and the pathway it travels, into the drinkable groundwater system or away from potable water sources. Accurate determination of heavy metal contamination is important to identify cumulative risks to people drinking water derived from these areas.

Sampling Techniques for Heavy Metals *(Example)*

(1) Generally, all metal samples collected are to be composite samples, i.e., flow/composite, time/composite, or hand composite.

(2) For composite sampling, place the lid on the bottle and agitate the bottle to completely mix the composite sample.

(3) Transfer the required amount from the composite container to either a 500 ml or 2000 ml clean plastic bottle. Check the pH of the sample.

Note: For inductively coupled plasma (ICP) metal analysis, a 500 ml clean plastic bottle is required. For extra metals or metals by furnace, a 2000 ml clean plastic bottle is required.

(4) Add nitric acid (1:1 solution) to the sample to reduce the pH to below 2.0. Usually, 2 ml/500 ml is sufficient. Recheck the pH to be sure it is below 2.0. Make a note on the lab sheet if more than two ml of acid is required to bring the pH below 2.0.

(5) Label the sample bottle with the corresponding IW number and proper analysis code letter. Attach the custody seal to the sample, then store in the ice chest until transferred to the laboratory. Fill out the IW lab sheet with all the pertinent information, being careful to include all required parameters and the type of analysis required, e.g., ICP/furnace.

(6) When a grab sample is necessary, rinse out the receiving sample bottle with an aliquot of the wastewater flow or sample stream at least three times. Then fill the sample bottle and proceed with steps two through four described above.

(7) When a split sample is requested (i.e., one for the samplers and one for the user), the composite sample is prepared as described in item one. Providing there is sufficient sample, a portion is transferred into the bottle provided by the user.

(8) If more than one site is sampled per day, a clean composite container (i.e., two and one half-gallon glass jar), must be used at each site.

(9) If a discrete sampler is being used, at the time of collection combine all the samples that have been collected into a single clean composite bottle. Then follow the preceding steps one through four, and refer to step six if a split is requested.

Acid/Base/Neutral Extractable Organics and Pesticides

Acid extractable organics are analyzed in accordance with EPA methods 604 and 625. Base/neutral extractable organics are analyzed in accordance with EPA method 625, or individual methods for various groups of compounds including EPA methods 605, 606, 607, 609, 611, and 612. Pesticides are analyzed in accordance with EPA method 608.

The procedures that must be followed in taking these samples are outlined below.

(1) Samples must be collected in certified clean one-gallon amber glass bottles with Teflon lids.

(2) No travel blanks or QA/QC bottles are required with the samples.

(3) Grab samples must be collected in amber glass bottles. They do not have to be completely filled, but must be a minimum of 1/3 to 1/2 full. Bottles should not be prewashed with samples prior to filling.

(4) For composite sampling, glass composite bottles must be used and precleaned. Teflon tubing must be used for the suction piping. The pump tubing must be medium grade silicone rubber.

(5) The composite bottle in the sampler must be kept refrigerated (putting ice in the sampler) at 4°C. If amber glass is not used (i.e. 2 1/2-gallon clear composite sampler bottle), the sample must be protected from the light during collection and compositing. The compositing must be done in the field (i.e. when discrete sampling has been used).

(6) All samples must be iced at 4°C from the time of collection until extraction.

(7) The sample should be checked for the presence of chlorine using field test kits that provide results in accordance with EPA methods 330.4 and 330.5. If chlorine is determined to be present, 80 mg of sodium thiosulfate should be added to each bottle. The sample must be retested for chlorine. This procedure must be repeated until there is no residual of chlorine shown. The amount of sodium thiosulfate added must be noted on the chain of custody if in excess of 80 mg.

(8) All necessary paperwork must be completed at sampling site. All bottles must be properly labeled, and have custody seals.

Cyanide *(Example)*

To assure that the sample can be analyzed for cyanide, no chlorine can be present in the sample. Procedures for taking cyanide samples are as follows:

(1) This sample is normally a grab sample. The cyanide sample is a composite sample when collected as part of Priority Pollutants or Plant Sampling at the POTW.

(a) In the sampling file, check the industries' wastewater discharge permit and locate all cyanide (CN) sampling sites. If the sampling sites are located in a confined space, follow Confined Space procedures before collecting the sample or samples.

(b) Collect 2000 ml (maximum), 1000 ml (minimum), of CN sample into a plastic bottle.

NOTE: 2000 ml is the standard, but for batch dischargers 1000 ml is adequate.

(c) Test the cyanide sample for pH and temperature with the pH meter. Record the results on the custody sheet (Industrial Waste (IW) lab sheet).

(d) Test for chlorine with a Total Chlorine Test Kit (the instructions are located in the kit)

(e) If chlorine is present in the CN sample, neutralize it with Ascorbic Acid ($C_6H_8O_6$). For ascorbic acid neutralization, add $C_6H_8O_6$, a few crystals at a time, until five mls of sample in the test tube produces no color. Then add an additional 0.06 g of $C_6H_8O_6$ for each liter of sample volume.

(f) Once all Cl_2 has been neutralized, preserve the sample with Sodium Hydroxide (NaOH) and raise the pH to >12. Verify the >12 pH with a pH meter or pH test strips.

(g) Mark on the side of the CN sample bottle the COC sheet number (using a water proof marker), and place a corresponding custody seal across the sample bottle tightened cap. Place a Cyanide label on the bottle if cyanide is suspected of being present in the sample.

(h) Cool and store the CN sample at 4°C and transport it to the laboratory.

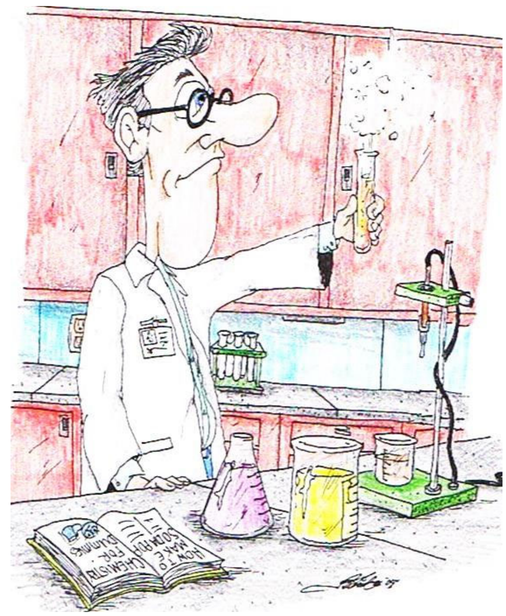
Total Sulfides *(Example)*

(1) The Total Sulfide sample is collected as a grab sample only. Use a clean 500 ml plastic bottle to collect the sample. This sample may be pumped into the sample container or collected directly from the discharge side of the sampling device.

(2) Preserve the sample with 1 ml of 2N Zinc Acetate ($C_4H_6O_4Zn$) and then add Sodium Hydroxide (NaOH) to raise the pH > 9.

(3) Label and seal the sample with a custody seal. Cool to 4°C.

Oil and Grease/TPH *(Example)*



EPA Method 1664A
Extraction of Oil and Grease from Water Samples Using Solid-Phase Extraction (SPE) Disk Configuration

Oil and Grease Disc Configuration Method
Acidify each 1L sample to pH < 2 using 6 M of HCl.

Place required number of samples (1–6) in the sample vial rack. Insert sample lines into each sample bottle.

Collection
Label the collection vials (1–6) and place these into the collection rack. Position the solvent bottles on the left side of the Dionex AutoTrace instrument.

Solvents
Add methanol to solvent bottle
1. Water (pH 2) to solvent bottle
2. Hexane/THF (1:1) to solvent bottle
3. Hexane to solvent bottle
4. And water to solvent bottle

5. Place these solvent bottles to the left side of the Dionex AutoTrace instrument and insert the solvent lines into the corresponding bottle (up to five different solvents can be used with the Dionex AutoTrace instrument). SPE Media Insert SPE disks onto the Dionex AutoTrace instrument (see Dionex (now part of Thermo Scientific) AutoTrace 280 Operation Manual for details1) and secure the disk into place using the disk holder. The green LED will be illuminated when the disk is locking into place.

METHOD 413.1 (Oil and Grease). Is no longer a valid procedure.

BOD/COD/SS *(Example)*

(1) 24-hour composite sampling is always used for this test. Agitate the bottle to completely mix the composite sample. Do not allow the solids to settle out before you pour off the sample.

(2) When more than one sample is being taken from a composite bottle, the BOD/COD/SS is taken first. The lab needs 1000 ml if the sample is cloudy or has solids. If the sample is clear, you must collect 2000 ml. Transfer the appropriate volume to the sample bottle.

(3) Take the pH/temperature of the sample with either pH paper and a thermometer, or the pH meter carried on the sampling trucks.

(4) Label the sample bottle and place a custody seal over the lid. Store at 4°C.

(5) Should split samples be requested, they are only supplied when it is sure there is enough sample for POTW's requirements. Users must provide their own sample containers and allow POTW's staff to pour off samples.

More on these samples in the Laboratory Analysis Chapter located in the rear of this course.

Virus Sampling *(Procedure Example)*

Viruses are microbiological organisms which can cause infectious diseases. Wastewater recharge and sewage disposal into the environment may contribute to the occurrence of viruses in surface water and groundwater. Viruses are the most mobile and infectious of the waterborne pathogens. Large volumes of water must be filtered to detect viruses. This involves passing the water samples through a cartridge filter by use of a gasoline driven pump.

(1) **Equipment Needed**
Most of the equipment required for virus sampling is available on the sampling trucks. However, some equipment is virus sampling specific. The needed equipment is as follows:

(a) Gasoline/oil powered water pump
(b) Hoses - intake (supplied with pump) and discharge (garden type, with female connectors at both ends)
(c) Two 55-gallon plastic containers
(d) Filter apparatus
(e) Cartridge filters
(f) Sodium thiosulfate (two 500 gram bottles/site)
(g) Gasoline can with gas/oil mixture
(h) Hach total chlorine test kit
(i) Large plastic Zip-lock bags (supplied with cartridges)
(j) Chain of custody sheets
(k) Thermometer
(l) Water-proof marker
(m) Latex gloves
(n) Liquid bleach
(o) Cooler with blue ice
(p) pH meter

(2) **Sampling Procedure**
Check the pump for gas/oil prior to starting (do not fill while it is running). Make sure the gas/oil mixture is correct by checking the mixing instructions on the side of the two-cycle pump oil can. Latex gloves should be worn for protection, and to prevent contamination of the filters.

Connect the hoses and filter housing (with no filter) to the pump, and run the effluent through it for one to two minutes to flush the system. Next, pump effluent into the two 55-gallon drums and rinse them out. (Note: If disinfection was not possible after the last sampling, then 50-100 gallons of effluent should be pumped through the entire equipment set up prior to placing the filter in the housing.)

Pump effluent almost to the top (just above the handles) of both containers. While the drums are filling, check the water in the drums for chlorine using a Hach test kit and record the results and the temperature on the custody sheet. If chlorine is present and needs to be eliminated, add 500 grams of sodium thiosulfate to each container to eliminate it. After visual observation has determined that all the sodium thiosulfate has dissolved, retest to make sure there is a <0.1 ppm chlorine residual. If chlorine was removed, take the hose from the channel, allow it to drain, and reprime the pump with the dechlorinated water.

Pump this water through the system to flush it, and adjust the flow to fill a one-gallon jug in about 15-20 seconds. Don't waste too much water, as the flow can be adjusted after the filter is inserted. Install the filter into the blue holder, being very careful not to touch it with your hands (wear clean latex gloves).

There are two black washers that go with the filter, one on the bottom and the other on the top. Make sure these are aligned with the filter housing to prevent leaking. Screw the holder and filter onto the apparatus.

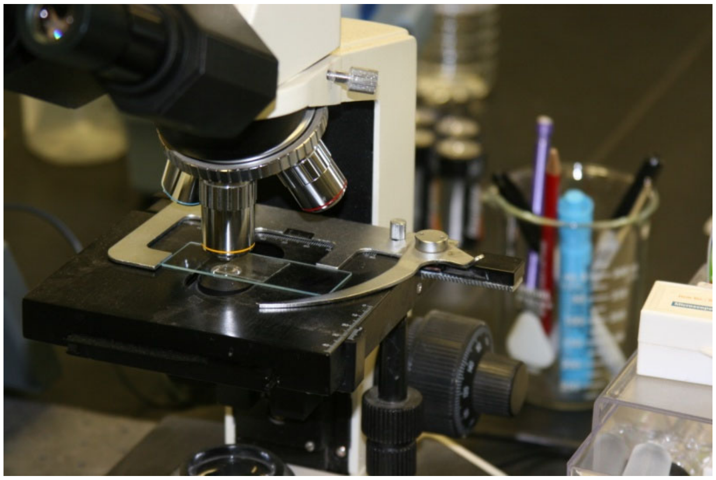
Refuel the pump, restart it, and adjust the water flow so that it is close to 15-20 seconds per gallon. Make sure the housing doesn't leak.

Try to keep this amount of flow, since too great a flow will cause pass-through in the filter. Pump the water from both containers until they are empty. Stop the pump, remove the filter (wear clean latex gloves), and place it in its original zip-lock bag. The washers do not need to go with the filter, but if they fall into the bag it is better to leave them than take the chance of contaminating the filter trying to remove them.

Fill in the information area on the zip-lock bag with a marker, indicating the plant being sampled and the date, and put it in the cooler with the blue ice provided. The blue ice keeps the temperature at 4°C to prevent significant die-off of the viruses.

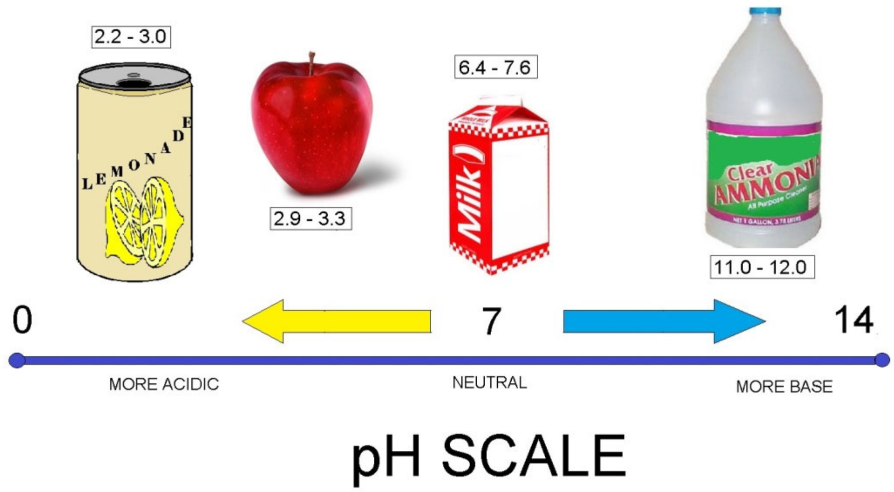
While at the site, or later at the plant, mix a half-gallon of bleach to 10 gallons of clean water. Pump it through the flow system and the containers. Rinse everything with fresh water and drain it so it is ready for the next time.

Let the pump cool before storing it. Store the gas/oil mixture in the warehouse flammable storage cabinet.



Parasitology Sampling
Parasitology sampling utilizes the same equipment and techniques as in the virus sampling described above. However, a different type of filter, which is provided by the Lab, is used.

pH Testing Sub-Section



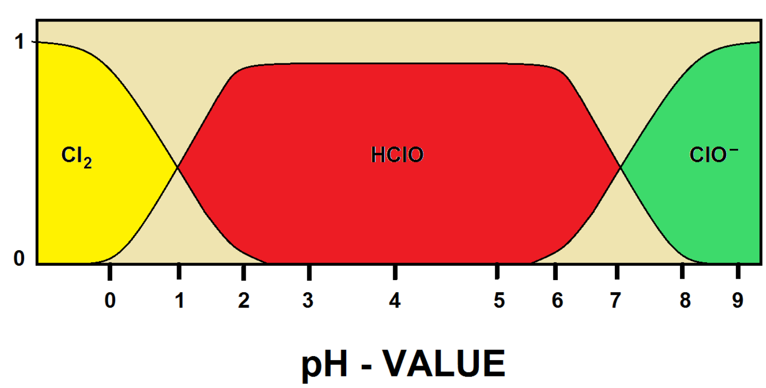
As a pretreatment inspector, you will need to master pH sampling and testing.

In water and wastewater processes, **pH** is a measure of the acidity or basicity of an aqueous solution. Solutions with a pH greater than 7 are basic or alkaline and solution or samples with a pH less than 7 are said to be acidic. Pure water has a pH very close to 7.

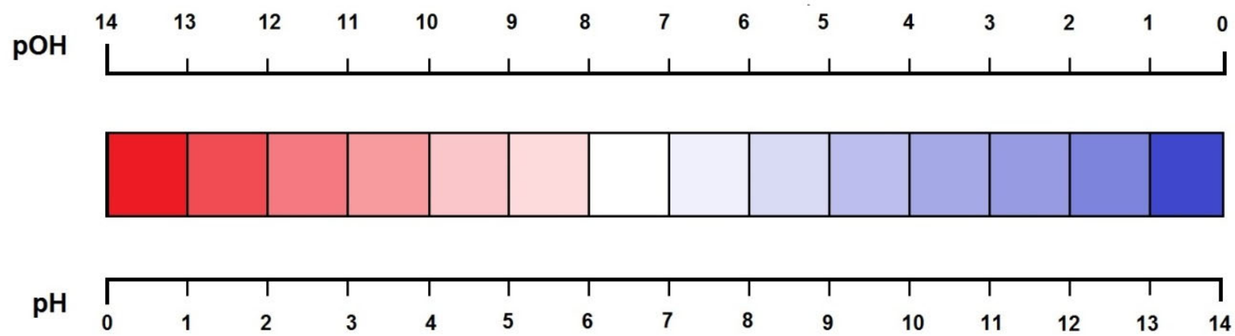
Primary pH standard values are determined using a concentration cell with transference, by measuring the potential difference between a hydrogen electrode and a standard electrode such as the silver chloride electrode. The pH scale is traceable to a set of standard solutions whose pH is established by international agreement.

Measurement of pH for aqueous solutions can be done with a glass electrode and a pH meter, or using indicators like strip test paper.

pH measurements are important in water and wastewater processes (sampling) but also in medicine, biology, chemistry, agriculture, forestry, food science, environmental science, oceanography, civil engineering, chemical engineering, nutrition, water treatment & water purification, and many other applications.



Mathematically, pH is the measurement of hydroxyl ion activity and expressed as the negative logarithm of the activity of the (solvated) hydronium ion, more often expressed as the measure of the hydronium ion concentration.



IN RELATION BETWEEN p(OH) AND p(H) (red= ACIDIC / blue= BASIC)

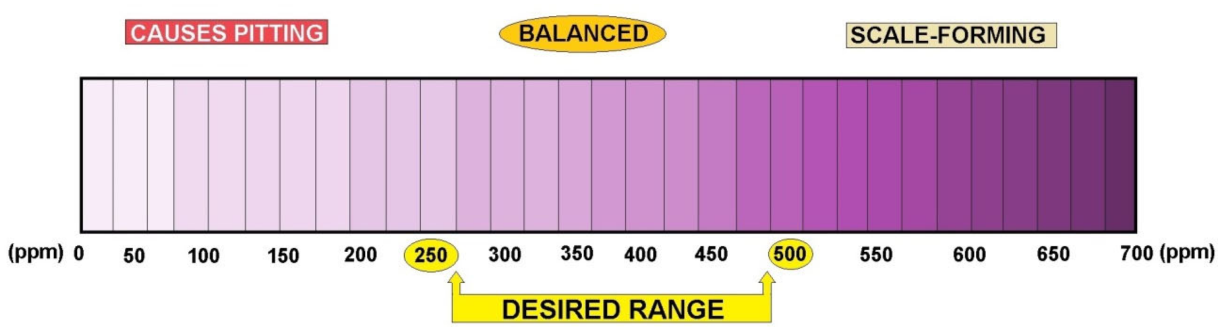
Contents

History

The scientific discovery of the p[H] concept of was first introduced by Danish chemist Søren Peder Lauritz Sørensen at the Carlsberg Laboratory back in 1909 and revised to the modern pH in 1924 to accommodate definitions and measurements in terms of electrochemical cells. In the first papers, the notation had the "H" as a subscript to the lowercase "p", as so: pH.

Alkalinity

Alkalinity is the quantitative capacity of an aqueous solution to neutralize an acid. Measuring alkalinity is important in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater. It is one of the best measures of the sensitivity of the stream to acid inputs. There can be long-term changes in the alkalinity of rivers and streams in response to human disturbances.



CALCIUM HARDNESS MEASUREMENT

Reference. Bates, Roger G. Determination of pH: theory and practice. Wiley, 1973.

pH Definition and Measurement

CONCENTRATION OF HYDROGEN IONS COMPARED TO DISTILLED H2O	pH	EXAMPLES OF SOLUTIONS AND THEIR RESPECTIVE pH
1/10,000,000	14	LIQUID DRAIN CLEANER CAUSTIC SODA
1/1,000,000	13	BLEACHES OVEN CLEANERS
1/100,000	12	SOAPY WATER
1/10,000	11	HOUSEHOLD AMMONIA (11.9)
1/1,000	10	MILK OF MAGNESIUM (10.5)
1/100	9	TOOTHPASTE (9.9)
1/10	8	BAKING SODA (8.4) / SEA WATER EGGS
0	7	"PURE" WATER (7)
10	6	URINE (6) / MILK (6.6)
100	5	ACID RAIN (5.6) BLACK COFFEE (5)
1000	4	TOMATO JUICE (4.1)
10,000	3	GRAPEFRUIT & ORANGE JUICE SOFT DRINK
100,000	2	LEMON JUICE (2.3) VINEGAR (2.9)
1,000,000	1	HYDROCHLORIC ACID SECRETED FROM STOMACH LINING (1)
10,000,000	0	BATTERY ACID

pH Scale

Technical Definition of pH
In technical terms, pH is defined as the decimal logarithm of the reciprocal of the hydrogen ion activity, *a*H+, in a solution.

$$pH = -\log_{10}(a_H+) = \log_{10}\left(\frac{1}{aH+}\right)$$

Ion-selective electrodes are often used to measure pH, respond to activity.

In this calculation of electrode potential, *E*, follows the Nernst equation, which, for the hydrogen ion can be written as

$$E = E^0 + \frac{RT}{F} \ln(a_H+) = E^0 - \frac{2.303RT}{F} pH$$

where *E* is a measured potential, E^0 is the standard electrode potential, *R* is the gas constant, *T* is the temperature in kelvin, *F* is the Faraday constant. For H^+ number of electrons transferred is one. It follows that electrode potential is proportional to pH when pH is defined in terms of activity.

International Standard ISO 31-8 is the standard for the precise measurement of pH as follows: A galvanic cell is set up to measure the electromotive force (EMF) between a reference electrode and an electrode sensitive to the hydrogen ion activity when they are both immersed in the same aqueous solution.

The reference electrode may be a silver chloride electrode or a calomel electrode. The hydrogen-ion selective electrode is a standard hydrogen electrode.

Reference electrode | concentrated solution of KCl || test solution | H_2 | Pt

Firstly, the cell is filled with a solution of known hydrogen ion activity and the emf, E_S, is measured. Then the emf, E_X, of the same cell containing the solution of unknown pH is measured.

$$pH(X) = pH(S) + \frac{E_s - E_x}{z}$$

The difference between the two measured emf values is proportional to pH. This method of calibration avoids the need to know the standard electrode potential. The proportionality

constant, *1/z* is ideally equal to $\frac{1}{2.303RT/F}$ the "Nernstian slope".

If you were to apply this practice the above calculation, a glass electrode is used rather than the cumbersome hydrogen electrode. A combined glass electrode has an in-built reference electrode. It is calibrated against buffer solutions of known hydrogen ion activity. IUPAC has proposed the use of a set of buffer solutions of known H^+ activity.

Two or more buffer solutions should be used in order to accommodate the fact that the "slope" may differ slightly from ideal.

The electrode is first immersed in a standard solution and the reading on a pH meter is adjusted to be equal to the standard buffer's value, to implement the proper calibration. The reading from a second standard buffer solution is then adjusted, using the "slope" control, to be equal to the pH for that solution. Further details, are given in the IUPAC recommendations.

When more than two buffer solutions are used the electrode is calibrated by fitting observed pH values to a straight line with respect to standard buffer values. Commercial standard buffer solutions usually come with information on the value at 25 °C and a correction factor to be applied for other temperatures. The pH scale is logarithmic and pH is a dimensionless quantity.

pH Indicators

Visual comparison of the color of a test solution with a standard color chart provides a means to measure pH accurate to the nearest whole number. Indicators may be used to measure pH, by making use of the fact that their color changes with pH.

More precise measurements are possible if the color is measured spectrophotometrically, using a colorimeter of spectrophotometer. Universal indicator consists of a mixture of indicators such that there is a continuous color change from about pH 2 to pH 10. Universal indicator paper is made from absorbent paper that has been impregnated with universal indicator.

pOH

pOH is sometimes used as a measure of the concentration of hydroxide ions, OH^-, or alkalinity. pOH values are derived from pH measurements. The concentration of hydroxide ions in water is related to the concentration of hydrogen ions by

$$[\mathrm{OH}^-] = \frac{K_W}{[\mathrm{H}^+]}$$

where K_W is the self-ionization constant of water. Taking logarithms

$$\mathrm{pOH} = \mathrm{pK_W} - \mathrm{pH}$$

So, at room temperature pOH ≈ 14 − pH. However this relationship is not strictly valid in other circumstances, such as in measurements of soil alkalinity.

Extremes of pH

Measurement of pH below about 2.5 (ca. 0.003 mol dm^{-3} acid) and above about 10.5 (ca. 0.0003 mol dm^{-3} alkali) requires special procedures because, when using the glass electrode, the Nernst law breaks down under those conditions.

Extreme pH measurements imply that the solution may be concentrated, so electrode potentials are affected by ionic strength variation. At high pH the glass electrode may be affected by "alkaline error", because the electrode becomes sensitive to the concentration of cations such as Na^+ and K^+ in the solution. Specially constructed electrodes are available which partly overcome these problems. Runoff from industrial outfalls, restaurant grease, mines or mine tailings can produce some very low pH values.

Non-aqueous Solutions

Hydrogen ion concentrations (activities) can be measured in non-aqueous solvents. pH values based on these measurements belong to a different scale from aqueous pH values, because activities relate to different standard states. Hydrogen ion activity, a_{H^+}, can be defined as:

$$a_{H+} = \exp\left(\frac{\mu_{H+} - \mu^{\ominus}_{H+}}{RT}\right)$$

where μ_{H^+} is the chemical potential of the hydrogen ion, $\mu^{\ominus}_{H^+}$ is its chemical potential in the chosen standard state, R is the gas constant and T is the thermodynamic temperature. Therefore pH values on the different scales cannot be compared directly, requiring an intersolvent scale which involves the transfer activity coefficient of hydrolyonium ion.

pH is an example of an acidity function. Other acidity functions can be defined. For example, the Hammett acidity function, H_0, has been developed in connection with superacids.

The concept of "Unified pH scale" has been developed on the basis of the absolute chemical potential of the proton. This scale applies to liquids, gases and even solids.

Applications

Water has a pH of $pK_w/2$, so the pH of pure water is about 7 at 25 °C; this value varies with temperature. When an acid is dissolved in water, the pH will be less than that of pure water. When a base, or alkali, is dissolved in water, the pH will be greater than that of pure water.

A solution of a strong acid, such as hydrochloric acid, at concentration 1 mol dm^{-3} has a pH of 0. A solution of a strong alkali, such as sodium hydroxide, at concentration 1 mol dm^{-3}, has a pH of 14. Thus, measured pH values will lie mostly in the range 0 to 14, though negative pH values and values above 14 are entirely possible.

Since pH is a logarithmic scale, a difference of one pH unit is equivalent to a tenfold difference in hydrogen ion concentration.

The pH of an aqueous solution of pure water is slightly different from that of, a salt such as sodium chloride even though the salt is neither acidic nor basic. In this case, the hydrogen and hydroxide ions' activity is dependent on ionic strength, so K_w varies with ionic strength. The pH of pure water decreases with increasing temperatures. One example is the pH of pure water at 50 °C is 6.55.

Seawater

The pH of seawater plays an important role in the ocean's carbon cycle, and there is evidence of ongoing ocean acidification caused by carbon dioxide emissions. pH measurement can be complicated by the chemical properties of seawater, and several distinct pH scales exist in chemical oceanography.

As part of its operational definition of the pH scale, the IUPAC defines a series of buffer solutions across a range of pH values (often denoted with NBS or NIST designation).

These solutions have a relatively low ionic strength (~0.1) compared to that of seawater (~0.7), and, as a consequence, are not recommended for use in characterizing the pH of seawater, since the ionic strength differences cause changes in electrode potential.

To resolve this problem, an alternative series of buffers based on artificial seawater was developed. This new series resolves the problem of ionic strength differences between samples and the buffers. The newest pH scale is referred to as the **total scale**, often denoted as **pH_T**.

Calculations of pH

The calculation of the pH of a solution containing acids and/or bases is an example of a chemical speciation calculation, that is, a mathematical procedure for calculating the concentrations of all chemical species that are present in the solution.

The complexity of the procedure depends on the nature of the solution.

If the pH of a solution contains a weak acid requires the solution of a quadratic equation.

If the pH of a solution contains a weak base may require the solution of a cubic equation.

For strong acids and bases no calculations are necessary except in extreme situations.

The general case requires the solution of a set of non-linear simultaneous equations.

A complicating factor is that water itself is a weak acid and a weak base. It dissociates according to the equilibrium

$$2H_2O \rightleftharpoons H_3O^+(aq) + OH^-(aq)$$

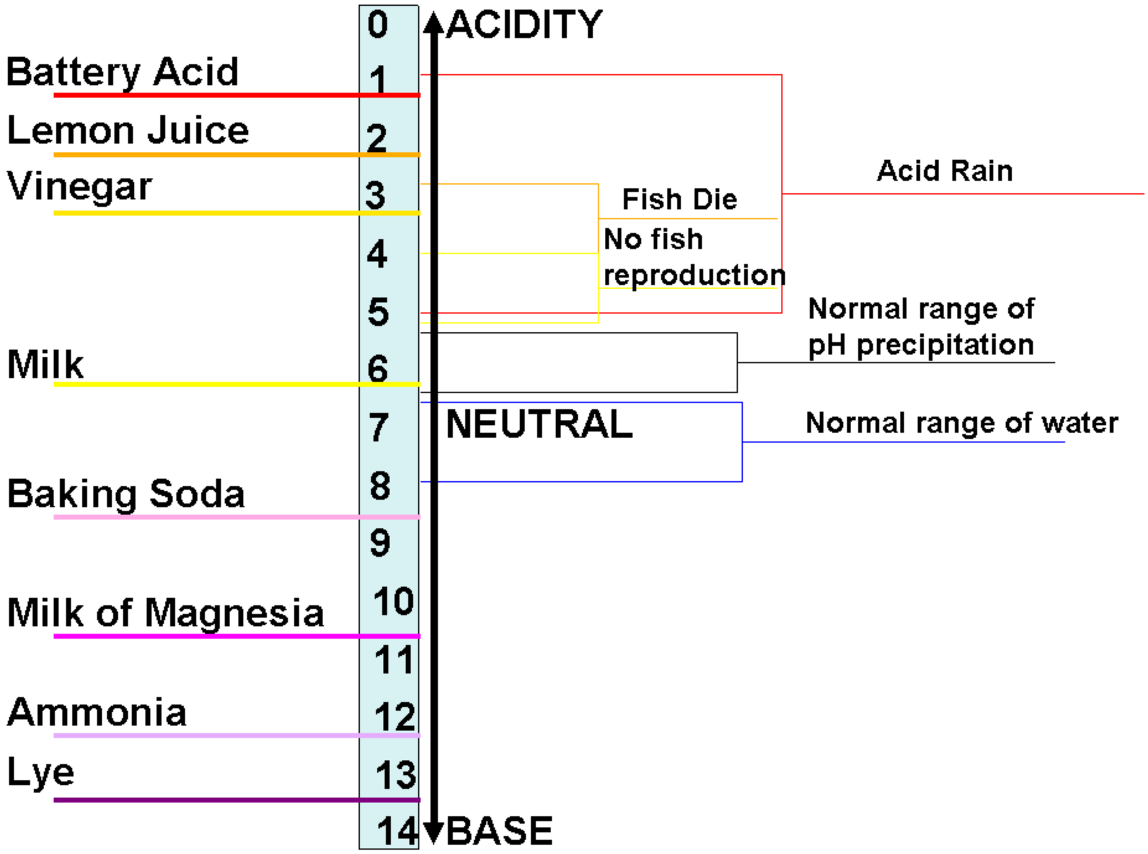
with a dissociation constant, K_w defined as

$$K_w = [H^+][OH^-]$$

where $[H^+]$ represents for the concentration of the aquated hydronium ion and $[OH^-]$ stands for the concentration of the hydroxide ion. K_w has a value of about 10^{-14} at 25 °C, so pure water has a pH of approximately 7.

This equilibrium needs to be considered at high pH and when the solute concentration is extremely low.

pH Summary



pH: A measure of the acidity of water. The pH scale runs from 0 to 14 with 7 being the mid-point or neutral. A pH of less than 7 is on the acid side of the scale with 0 as the point of greatest acid activity. A pH of more than 7 is on the basic (alkaline) side of the scale with 14 as the point of greatest basic activity.

pH = (**Power of Hydroxyl Ion Activity**).
The acidity of a water sample is measured on a pH scale. This scale ranges from **0** (maximum acidity) to **14** (maximum alkalinity). The middle of the scale, **7**, represents the neutral point. The acidity increases from neutral toward **0**.

Because the scale is logarithmic, a difference of one pH unit represents a tenfold change. For example, the acidity of a sample with a pH of **5** is ten times greater than that of a sample with a pH of **6**. A difference of 2 units, from **6** to **4**, would mean that the acidity is one hundred times greater, and so on.

Normal rain has a pH of **5.6** – slightly acidic because of the carbon dioxide picked up in the earth's atmosphere by the rain.

Strong Acids and Bases

Strong Acids and Bases
Strong acids and bases are compounds that, for practical purposes, are completely dissociated in water. Under normal circumstances, this means that the concentration of hydrogen ions in acidic solution can be taken to be equal to the concentration of the acid. The pH is then equal to minus the logarithm of the concentration value.

Hydrochloric acid (HCl) is an example of a strong acid. The pH of a 0.01M solution of HCl is equal to $-\log_{10}(0.01)$, that is, pH = 2.

Sodium hydroxide, NaOH, is an example of a strong base. The p[OH] value of a 0.01M solution of NaOH is equal to $-\log_{10}(0.01)$, that is, p[OH] = 2.

From the definition of p[OH] above, this means that the pH is equal to about 12. For solutions of sodium hydroxide at higher concentrations, the self-ionization equilibrium must be taken into account.

Weak Acids and Bases
A weak acid or the conjugate acid of a weak base can be treated using the same formalism.

Acid: $HA \rightleftharpoons H^+ + A^-$
Base: $HA^+ \rightleftharpoons H^+ + A$

First, an acid dissociation constant is defined as follows. Electrical charges are omitted from subsequent equations for the sake of generality

$$K_a = \frac{[H][A]}{[HA]}$$

and its value is assumed to have been determined by experiment. This being so, there are three unknown concentrations, [HA], $[H^+]$ and $[A^-]$ to determine by calculation. Two additional equations are needed.

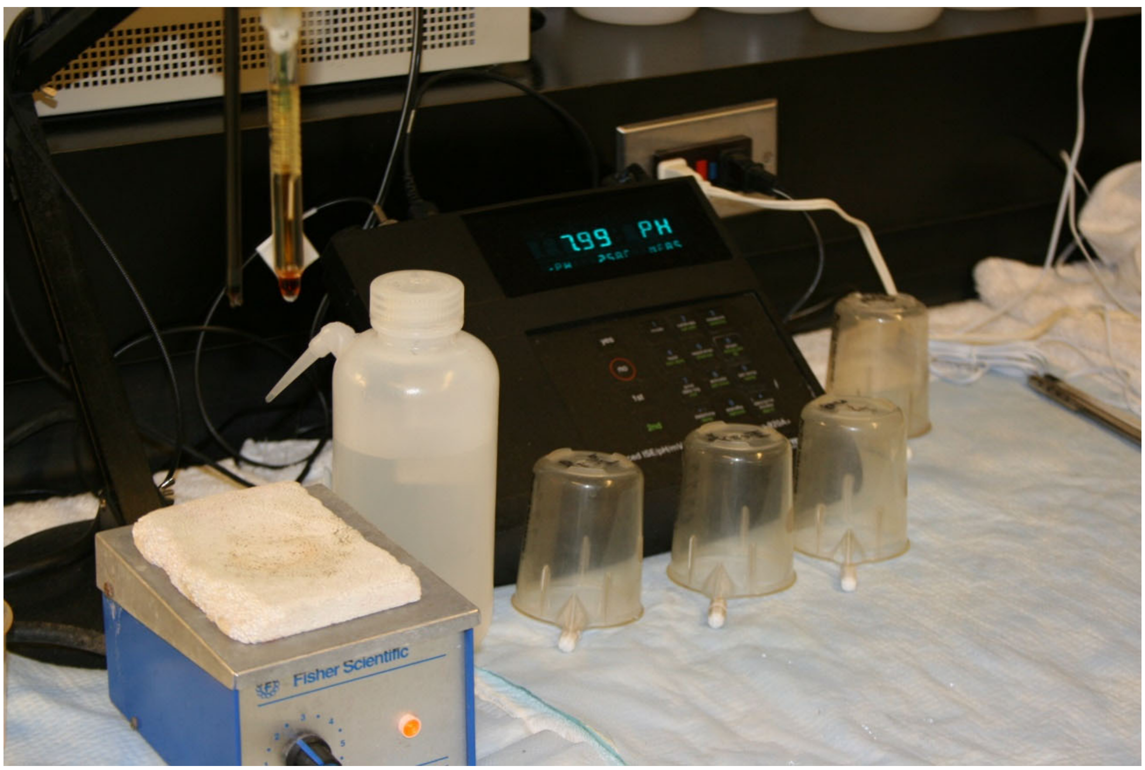
One way to provide them is to apply the law of mass conservation in terms of the two "reagents" H and A.

$$C_A = [A] + [HA]$$
$$C_H = [H] + [HA]$$

C stands for analytical concentration. In some texts one mass balance equation is replaced by an equation of charge balance. This is satisfactory for simple cases like this one, but is more difficult to apply to more complicated cases as those below.

Together with the equation defining K_a, there are now three equations in three unknowns. When an acid is dissolved in water $C_A = C_H = C_a$, the concentration of the acid, so [A] = [H]. After some further algebraic manipulation an equation in the hydrogen ion concentration may be obtained.

$$[H]^2 + K_a[H] - K_aC_a = 0$$



Alkalinity

Introduction

Alkalinity of water is its acid-neutralizing capacity. It is the sum of all the titratable bases. The measured value may vary significantly with the end-point pH used. Alkalinity is a measure of an aggregate property of water and can be interpreted in terms of specific substances only when the chemical composition of the sample is known.

Alkalinity is significant in many uses and treatments of natural waters and wastewaters. Because the alkalinity of many surface waters is primarily a function of carbonate, bicarbonate, and hydroxide content, it is taken as an indication of the concentration of these constituents. The measured values also may include contributions from borates, phosphates, silicates or other bases if these are present. Alkalinity in excess of alkaline earth metal concentrations is significant in determining the suitability of water for irrigation. Alkalinity measurements are used in the interpretation and control of water and wastewater treatment processes.

Titration Method

a. Principle

Hydroxyl ions present in a sample, because of dissociation or hydrolysis of solutes react with additions of standard acid. Alkalinity thus depends on the end-point pH used.

b. Reagents

i) Standard Hydrochloric Acid – 0.02 N.
ii) Methyl Orange Indicator – Dissolve 0.1 g of methyl orange in distilled water and dilute to 1 liter.
iii) Sodium carbonate solution, 0.02 N : Dry 3 to 5 g primary standard Na_2CO_3 at 250°C for 4 h and cool in a desiccator. Weigh 1.03 gm.
(to the nearest mg), transfer to a 1-L volumetric flask, fill flask to the mark with distilled water, dissolve and mix reagent. Do no keep longer than 1 week.

c. Procedure

Titrate over a white surface 100 ml of the sample contained in a 250-ml conical flask with standard hydrochloric acid using two or three drops of methyl orange Indicator.
(**NOTE** – If more than 30 ml of acid is required for the titration, a smaller suitable aliquot of the sample shall be taken.)

d. Calculation

Total alkalinity (as $CaCO_3$), mg/l = 10 V or NxVx50x1000

T.A. (as $CaCO_3$) = ----------------------
Sample Amount

Where N = Normality of HCl used
V = volume in ml of standard hydrochloric acid used in the titration.

Alkalinity to Phenolphthalein

The sample is titrated against standard acid using phenolphthalein indicator.

a. Reagents

i) Phenolphthalein Indicator Solution :

Dissolve 0.1 g of phenolphthalein in 60 ml of ETHANOL and dilute with Distilled water to 100 ml.
ii) Standard hydrochloric Acid – 0.02 N.

b. Procedure
Add 2 drops of phenolphthalein indicator solution to a sample of suitable size, 50 or 100 ml, in a conical flask and titrate over a while surface with standard hydrochloric acid.

c. Calculation

Alkalinity to phenolphthalein (as $CaCO_3$), mg/l $= \frac{1000\,V_1}{V_2}$

Where
V_1 = volume in ml of standard hydrochloric acid used in the titration, and
V_2 = Volume in ml of the sample taken for the test.

Caustic Alkalinity

a. General
Caustic alkalinity is the alkalinity corresponding to the hydroxides present in water and is calculated from total alkalinity (T) and alkalinity to phenolphthalein (P).

b. Procedure Determine total alkalinity and alkalinity to phenolphthalein and calculate caustic alkalinity as shown in Table below. Result of Titration Caustic Alkalinity or Hydroxide Alkalinity as $CaCO_3$ Carbonate Alkalinity as $CaCO_3$ Bicarbonate Concentration as $CaCO_3$ **Result of Titration**	**Caustic Alkalinity or Hydroxide Alkalinity as $CaCO_3$**	**Carbonate Alkalinity as $CaCO_3$**	**Bicarbonate Concentration as $CaCO_3$**
P=0	0	0	0
P<1/2T	0	2P	T-2P
P=1/2T	0	2P	0
P>1/2T	2P-T	2(T-P)	0
P=T	T	0	0

The alkalinity of water is a measure of its capacity to neutralize acids. The alkalinity of natural water is due to the salts of carbonate, bicarbonate, borates, silicates and phosphates along with the hydroxyl ions in free state.

However, the major portion of the alkalinity in natural waters is caused by hydroxide, carbonate, and bicarbonates that may be ranked in order of their association with high pH values.

Alkalinity values provide guidance in applying proper doses of chemicals in water and wastewater treatment processes, particularly in coagulation and softening.

Alkalinity (Total)

References: ASTM D 1067-92, Acidity or Alkalinity of Water.
APHA Standard Methods, 19th ed., p. 2-26, method 2320B (1995).
EPA Methods for Chemical Analysis of Water and Wastes, method 310.1 (1983).

The alkalinity of water is a measurement of its buffering capacity or ability to react with strong acids to a designated pH. Alkalinity of natural waters is typically a combination of bicarbonate, carbonate, and hydroxide ions. Sewage and wastewaters usually exhibit higher alkalinities either due to the presence of silicates and phosphates or to a concentration of the ions from natural waters.

Alkalinity inhibits corrosion in boiler and cooling waters and is therefore a desired quality that must be maintained. Alkalinity is also measured as a means of controlling water and wastewater treatment processes or the quality of various process waters. In natural waters, excessive alkalinity can render water unsuitable for irrigation purposes and may indicate the presence of industrial effluents.

The Titrimetric Method
CHEMetrics' tests determine total or "M" alkalinity using an acid titrant and a pH indicator. The end point of the titration occurs at pH 4.5. Results are expressed as ppm (mg/L) $CaCO_3$.

Hardness (calcium)
Reference: West, T. S., DSC, Ph.D., Complexometry with EDTA and Related Reagents, 3rd ed., p. 46, 164 (1969).

Originally described as water's capacity to precipitate soap, hardness is one of the most frequently determined qualities of water. It is a composite of the calcium, magnesium, strontium, and barium concentrations in a sample. The current practice is to assume total hardness refers to the calcium and magnesium concentrations only.

Completely de-hardened water, resulting from sodium zeolite or other suitable ion exchange treatment, is required for various processes-including power generation, printing and photo finishing, pulp and paper manufacturing, and food and beverage processing. Hard water can cause scale formation on heat exchange surfaces, resulting in decreased heat transfer and equipment damage.

The Titrimetric Method. This method is specific for calcium hardness. The EGTA titrant in alkaline solution is employed with zincon indicator. Results are expressed as ppm (mg/L) $CaCO_3$.

Shelf life. 8 months. Although the reagent itself is stable, the endpoint indicator has a limited shelf-life. We recommend stocking quantities that will be used within 7 months.

FACTOR	TYPE	SOURCE(S)	PROBLEM
FECAL COLIFORM BACTERIA	BIOLOGICAL	HUMAN SEWAGE; LIVESTOCK WASTE	POSSIBLE PRESENCE OF PATHOGENIC (DISEASE-CAUSING) ORGANISMS
DISSOLVED OXYGEN (DO)	CHEMICAL	AIR; AQUATIC PLANTS	LOW LEVELS CAN KILL AQUATIC ORGANISMS
NITROGEN AND PHOSPHORUS	CHEMICAL	FERTILIZERS AND DETERGENTS FROM LAWNS AND RUNOFF	EXCESSIVE ALGAE GROWTH CAN LEAD TO LOW DO
ZINC, ARSENIC, LEAD, MERCURY, CADMIUM, NICKEL	CHEMICAL	LANDFILLS; INDUSTRIAL DISCHARGES; RUNOFF	GENETIC MUTATIONS OR DEATH IN FISH & WILDLIFE (HUMAN HEALTH THREATS AS WELL)
SALT	CHEMICAL	SALTWATER INTRUSION (IF NEAR OCEAN)	KILLS FRESHWATER SPECIES OF PLANTS AND ANIMALS
MUD, SAND, OTHER SOLID PARTICLES (TURBIDITY)	PHYSICAL	EROSION AND RUNOFF FROM DEVELOPMENT; AGRICULTURE	REDUCES PHOTOSYNTHESIS IN AQUATIC VEGETATION; INTERFERES WITH RESPIRATION IN AQUATIC ANIMALS

WATER QUALITY FACTORS

Dissolved Oxygen

Dissolved oxygen (**DO**) in water is not considered a contaminant. However, the (DO) level is important because too much or not enough dissolved oxygen can create unfavorable conditions. Generally, a lack of (DO) in natural waters creates anaerobic conditions.

Anaerobic means without air. Certain bacteria thrive under these conditions and utilize the nutrients and chemicals available to exist. *Under anaerobic conditions the reaction is:*

Anaerobic:

Organics-→ intermediates + CO_2 + H_2O + energy

Where the intermediates are butyric acid, mercaptans and hydrogen sulfide gas. At least two general forms of bacteria act in balance in a wastewater digester. Saprophytic organisms and Methane Fermenters. The saprophytes exist on dead or decaying materials. The methane fermenters live on the volatile acids produced by these saprophytes. The methane fermenting bacteria require a pH range of 6.6 to 7.6 to be able to live and reproduce.

Aerobic:

Organics + Oxygen-→ CO_2 + H_2O + energy

Aerobic conditions indicate that dissolved oxygen is present. Aerobic bacteria require oxygen to live and thrive. When aerobes decompose organics in the water, the result is carbon dioxide and water. Dissolved Oxygen in a water sample can be detrimental to metal pipes in high concentrations because oxygen helps accelerate corrosion.

Oxygen is an important component in water plant operations. Its primary value is to oxidize iron and manganese into forms that will precipitate out of the water. It also removes excess carbon dioxide. The amount of dissolved oxygen in a water sample will affect the taste of drinking water also.

Methods of Determination

There are two methods that we will be using in the lab. The membrane electrode method procedure is based on the rate of diffusion of molecular oxygen across a membrane.

The other is a titrimetric procedure (Winkler Method) based on the oxidizing property of the (DO). Many factors determine the solubility of oxygen in a water sample. Temperature, atmospheric pressure, salinity, biological activity and pH all have an effect on the (DO) content.

Iodometric Test

The Iodometric (titration) test is very precise and reliable for (DO) analysis of samples free from particulate matter, color and chemical interferences. Reactions take place with the addition of certain chemicals that liberate iodine equivalent to the original (DO) content. The iodine is then measured to the starch iodine endpoint. We then calculate the dissolved oxygen from how much titrate we use.

Certain oxidizing agents can liberate iodine from iodides (positive interference), and some reducing agents reduce iodine to iodide (negative interferences). The alkaline Iodide-Azide reagent effectively removes interference caused by nitrates in the water sample, so a more accurate determination of (DO) can be made.

Methods of analysis are highly dependent on the source and characteristics of the sample. The membrane electrode method involves an oxygen permeable plastic membrane that serves as a diffusion barrier against impurities, only molecular oxygen passes through the membrane and is measured by the meter. This method is excellent for field testing and continuous monitoring.

Membrane electrodes provide an excellent method for (DO) analysis in polluted, highly colored turbid waters and strong waste effluents. These interferences could cause serious errors in other procedures. Prolonged usage in waters containing such gases as H_2S tends to lower cell sensitivity. Frequent changing and calibrating of the electrode will eliminate this interference.

Samples are taken in BOD bottles where agitation or contact with air is at a minimum. Either condition can cause a change in the gaseous content. Samples must be determined immediately for accurate results. The dissolved oxygen test is the one of the most important analyses in determining the quality of natural waters.

The effect of oxidation wastes on streams, the suitability of water for fish and other organisms and the progress of self-purification can all be measured or estimated from the dissolved oxygen content. In aerobic sewage treatment units, the minimum objectionable odor potential, maximum treatment efficiency and stabilization of wastewater are dependent on maintenance of adequate dissolved oxygen. Frequent dissolved oxygen measurement is essential for adequate process control.

Topic 8 - Pretreatment and Wastewater Sampling Section Post Quiz

pH Section

1. What is the proper term used that are determined using a concentration cell with transference, by measuring the potential difference between a hydrogen electrode and a standard electrode such as the silver chloride electrode?

2. In chemistry, *pH* is a measure of the acidity or basicity of an aqueous solution. Solutions with a pH less than 7 are said to be acidic and solutions with a pH greater than 7 are basic or alkaline. Pure water has a pH very close to?

3. Mathematically, pH is the negative logarithm of the activity of the (solvated) hydronium ion, more often expressed as the measure of the?

4. Which terms is used for aqueous solutions can be done with a glass electrode and a pH meter, or using indicators?

5. The pH scale is logarithmic and therefore pH is?

6. Measuring alkalinity is important in determining a stream's ability to neutralize acidic pollution from rainfall or wastewater. It is one of the best measures of the sensitivity of the stream to acid inputs. There can be long-term changes in the _________________ of rivers and streams in response to human disturbances.

7. pH is defined as the decimal logarithm of the reciprocal of the_____________, $a_{H}+$, in a solution.

8. Alkalinity is the name given to the quantitative capacity of an aqueous solution to neutralize an?

9. What is the term used for the color of a test solution with a standard color chart provides a means to measure pH accurate to the nearest whole number?

10. The calculation of the pH of a solution containing acids and/or bases is an example of a chemical speciation calculation, that is, a mathematical procedure for calculating the concentrations of all chemical species that are present in the solution. The complexity of the procedure depends on the?

11. Under normal circumstances this means that the concentration of hydrogen ions in acidic solution can be taken to be equal to the concentration of the acid. The pH is then equal to minus the logarithm of?

12. Alkalinity of water is its acid-neutralizing capacity. It is the sum of all the titratable bases. The measured value may vary significantly with the?

13. For strong acids and bases no calculations are necessary except in extreme situations. The pH of a solution containing a weak acid requires the solution of a quadratic equation. The pH of a solution containing a weak base may require the?

14. Alkalinity is a measure of this missing term and can be interpreted in terms of specific substances only when the chemical composition of the sample is known.

15. More precise measurements are possible if the color is measured spectro-photometrically, using a?

16. For strong acids and bases no calculations are necessary except in extreme situations. The pH of a solution containing a weak acid requires?

17. The calculation of the pH of a solution containing acids and/or bases is an example of a _______________ calculation, that is, a mathematical procedure for calculating the concentrations of all chemical species that are present in the solution

18. What is the term used for measurements in the interpretation and control of water and wastewater treatment processes?

19. What is the term used for compounds that, for practical purposes, are completely dissociated in water?

20. Sodium hydroxide, NaOH, is an example of a?

Topic 9 - Standard and Special Conditions Section

Topic 9 - Section Focus: You will learn the basics of the pretreatment program's permit conditions. At the end of this section, you will be able to understand and describe standard and special permit requirements. Standard and special conditions outline the general duties and responsibilities of each Industrial User. The order, language, and format of the standard conditions in permits are a matter of the Control Authority's discretion. The permit writer will understand the necessity of utilizing use clear and specific language. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 9 – Scope/Background: Depending on the amount of detail provided in the Control Authority's sewer use ordinance, standard conditions for Industrial User permits may be taken from the Control Authority's sewer use ordinance and incorporated verbatim into the control mechanisms. The Control Authority can also condense or expand provisions from its sewer use ordinance and use them as standard conditions as long as the conditions in the control mechanism are consistent with the provisions in the sewer use ordinance.

9.1 Industrial User's Permit (Credit EPA)

The standard conditions in an Industrial User's permit should set forth the administrative and procedural requirements that are applicable to all Industrial Users and therefore should be repeated verbatim in every permit. Standard conditions are an essential element of every permit. Unless there are changes to the Control Authority's legal authority, the standard conditions might be developed only once. Standard conditions often reiterate many provisions contained in the sewer use ordinance. Such reiteration is the best way of notifying the Industrial User of its responsibilities and the procedural and administrative aspects of the permit program.

Standard conditions outline the general duties and responsibilities of each Industrial User. The order, language, and format of the standard conditions in permits are a matter of the Control Authority's discretion. Examples are provided in Table 9-1. The permit writer should use clear and specific language. This will ensure an adequate understanding of the provisions by all parties and avoid ambiguity that could give rise to alternative interpretations that could hinder enforceability. The Control Authority should have its attorney review the conditions before they are used in permits to ensure that there is adequate authority in the sewer use ordinance for each provision and that they are understandable and free of legal loopholes.

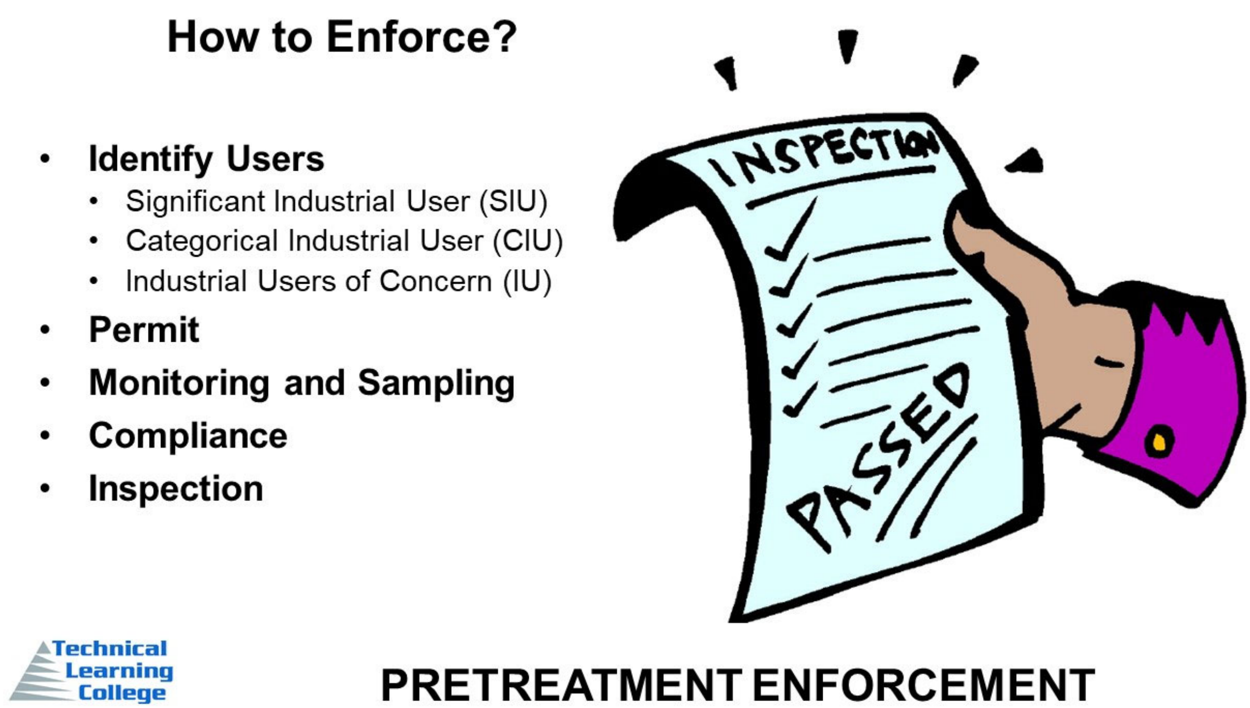


TABLE 9-1 EXAMPLES OF DIFFERENT LANGUAGE USED TO INCORPORATE STANDARD CONDITIONS INTO INDUSTRIAL USER PERMITS PERMIT MODIFICATION OR REVISION

Example No. 1: The City reserves the right to amend this permit at any time, in accordance with Topic 13.16 Code of General Ordinances, to provide for more stringent limitations or requirements.

Example No. 2: The City may modify the terms of the permit to meet the City's NPDES discharge permit requirements, if substantial changes of the permittee's operations or wastewater occur, if applicable federal Pretreatment Standards are amended, or if the Superintendent of the City's treatment works determines that there is other good cause. To the extent otherwise permissible by law, changes or new conditions in the permit must include a reasonable schedule for compliance.
Example No 3: The City may modify the terms and conditions of this permit at any time as identified in Section 29.03(5) of the City's sewer use ordinance. Any new conditions in the permit must include a reasonable time schedule for compliance unless the modification incorporates a new requirement that includes an alternative compliance schedule. The City may also modify the permit to incorporate special conditions resulting from the issuance of a special order.

DILUTION OR EXCESSIVE DISCHARGE
Example No. 1: An industry may not increase the use of potable or process water in any way or mix separate wastestreams for the purpose of diluting a discharge as a partial or complete substitute for adequate treatment to achieve compliance with any applicable federal Pretreatment Standards, limits in Section 29.02 of the City's Ordinance, or any other limitations set forth in this permit.
Example No. 2: The permittee may not increase the use of process water or, in any way, attempt to dilute a discharge to achieve compliance with the limitations contained in this permit.

Proper Disposal of Pretreatment Sludges and Hazardous Wastes

Example No 1: The disposal of sludges generated within wastewater treatment systems must be in accordance with applicable state and federal regulations, specifically section 405 of the Clean Water Act and Subtitle C and D of the Resource Conservation and Recovery Act and section 319-333 of the state code.
Example No 2: Solids, sludges, filter backwash, or other pollutants removed in the course of treatment or control of wastewater must be disposed of in a manner such as to prevent any such materials from entering the Authority's sewerage system.

Depending on the amount of detail provided in the Control Authority's sewer use ordinance, standard conditions for Industrial User permits may be taken from the Control Authority's sewer use ordinance and incorporated verbatim into the control mechanisms. The Control Authority can also condense or expand provisions from its sewer use ordinance and use them as standard conditions as long as the conditions in the control mechanism are consistent with the provisions in the sewer use ordinance.

Some of the standard conditions ordinarily contained in an Industrial User's permit are below. Example language used to specify such conditions are in Appendix F, Sample Standard Conditions for Permits.

- *Definitions of terms* used in the permit. Terms that might need to be defined include composite and grab samples; instantaneous measurement; 4-day average, monthly average, or 30-day average; slug discharge; and effluent data and upset.
- The Industrial User's *duty to comply* with all provisions of the permit and the local sewer use ordinance, including the duty to comply with the general discharge prohibitions. (In some cases, the general discharge prohibitions may be included verbatim as a separate standard condition.)
- The Industrial User's *duty to comply* with all *applicable federal Pretreatment Standards* including those that become effective during the term of the permit and that compliance with the permit is not a defense for violation of applicable federal Pretreatment Standards.

• The Industrial User's *duty to provide information* to the Control Authority. Within a reasonable time, the Industrial User is required to submit any information that the Control Authority may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit.
• The Industrial User's *duty to mitigate* or to take all reasonable measures to lessen the duration and severity of any permit violation.
• The POTW's *authority to modify or revise* an Industrial User's permit at any time during the permit's effective term if certain conditions (such as new information, new federal standards, or evidence of fraud in the permit application) arise.
• Notice that the permit does not convey any *property rights* of any sort, or any exclusive privilege.
• *Need to halt or reduce activity not a defense*. It must not be a defense for an Industrial User in an enforcement action that it would have been necessary to halt or reduce the permitted activity to maintain compliance with the conditions of the permit.
• *Notice that the permit can be revoked* if violations of permit conditions or local ordinances are identified or the falsification or misrepresentation of information by the Industrial User is determined.
• *Nontransferability* of the permit if there is a change of owner or operator. The permit is issued to a specific entity and cannot be transferred by the Industrial User.
• *Right of appeal* provided to the Industrial User within a limited period after permit issuance after which the right to challenge or appeal administratively or in a court of law is deemed waived.
• *A severability clause* that allows the remaining parts of a permit to remain in force if any portion of the permit is found invalid and subsequently is suspended or revoked by a court of law.
• The Industrial User's responsibility or *duty to reapply* for a new permit before expiration of the current permit.
• Provisions requiring the installation and proper *operation and maintenance of wastewater treatment facilities* by the Industrial User, including proper calibration and maintenance of all sampling equipment.
• Provisions requiring the proper *disposal or treatment* of *sludges and other wastes* (e.g., spent chemicals) generated at the Industrial User's facility so as to prevent the discharge of such materials to the POTW.
• A condition that *prohibits* the *dilution* of Industrial User wastewaters as a partial or complete substitute for treatment of the wastewaters before discharge to the POTW.
• *Monitoring requirements* (in addition to those specified in other portions of the permit) including
  – An outline of specific records to be maintained during sampling events (i.e., name of individuals who performed the sampling; date, time, sample method used, and location of sampling; name of the individuals who performed the analysis; date and time of analyses; analytical method used; and the results of such analysis)
  – The requirement to follow EPA-approved sampling methods in 40 CFR Part 136, or other EPA-approved methods
  – The requirement to implement Quality Assurance/Quality Control (QA/QC) procedures such as proper installation and maintenance of flow-monitoring and sampling equipment, periodic calibration of sampling and monitoring devices, and laboratory QA/QC procedures
  – The requirement to resample within 30 days of an identified effluent violation
  • *Reporting requirements* (in addition to those specified in other portions of the permit), such as
  – The name and address of Control Authority personnel to whom applicable compliance monitoring reports are to be submitted
  – The requirement to notify the Control Authority of spills, slug loadings, accidental discharges of concern, upsets, or bypasses
  – The requirement to notify the Control Authority of any *planned changes* in industrial processes, production rates, or in the volume or characteristics of wastewaters discharged to the POTW, including changes that could affect slug discharge potential
  – Requirement that the Control Authority be *notified within 24 hours* of an identified effluent violation

– Requirement that the Control Authority be notified of any changes in flow that would change the status of NSCIU or reduce monitoring

– Requirement to submit resampling results within 30 days of an identified effluent violation

• A condition that requires the Industrial User to *maintain or retain records* related to industrial operations and wastewater discharges for a minimum of three years.

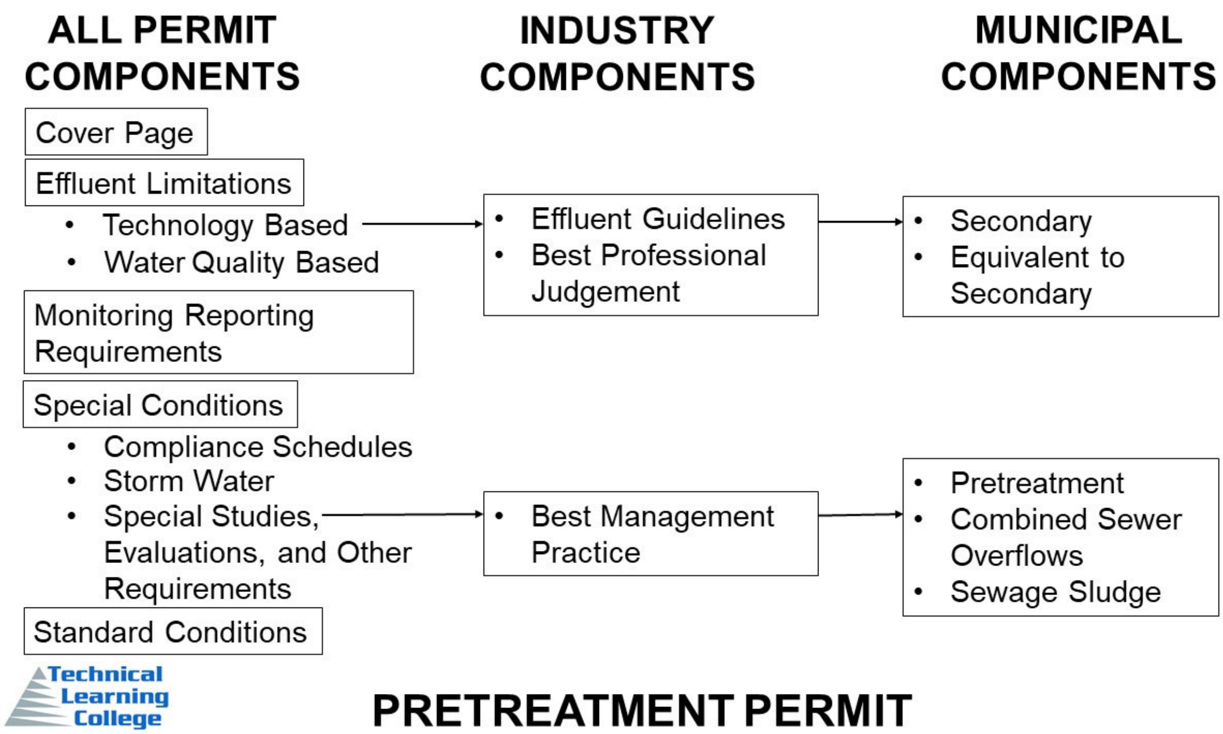
• Specific *signatory requirements* for all reports submitted to the Control Authority. In all cases, reports must be signed in accordance with the federal regulations [40 CFR 403.12(l)].

• Provisions that address *public access* to Industrial User records and the maintenance of *confidential information*. It should be made clear that at no time can wastewater effluent data or any other information used to develop permit limits (including production data) be claimed or held as confidential information.

• The *right of entry* or *right of access* of Control Authority personnel or its representatives to the Industrial User's property where a regulated facility or activity is located or conducted, or where records must be kept under the conditions of this permit. The Control Authority personnel or its representative must be granted access to perform sampling and inspection activities and to examine and copy Industrial User records.

• *Legal remedies* or enforcement measures including penalties available to the Control Authority to address violations of permit conditions.

Neither the discussion above nor the list provided in Appendix F exhausts all potential standard conditions that could be included in an Industrial User's permit. Both lists merely represent some of the more important types of conditions to be placed in the permit. The Control Authority and permit writer can establish additional standard conditions as deemed appropriate.



9.2 Special Conditions

Special conditions are based on the permit writer's professional judgment and specialized knowledge of the individual Industrial User. Because they are often based on the general authority established in the local ordinance and involve some exercise of judgment on the part of the permit writer, special conditions are more likely to be challenged. Therefore, their basis must be well documented and their use should be based on the fundamental principle of *reasonableness*.

Special conditions are tailored to each permittee. They typically address situations that are specific to certain types of industrial facilities. In addition, they might address known or suspected problems (e.g., spills) by requiring the Industrial User to undertake a specific activity to reduce the quantity of pollutants currently discharged or to prevent the discharge of new or additional pollutants. These special requirements are typically described in a separate section of the permit. Examples of a few special conditions include compliance schedules, developing and implementing Industrial User management practices, and additional monitoring requirements.

9.3 Compliance Schedules
A compliance schedule establishes milestones and deadlines for carrying out specific actions required of an Industrial User. For example, a compliance schedule may be used to delineate the phases for constructing or installing wastewater pollution control (treatment) technology or for submitting a spill plan. Each compliance schedule typically includes a brief outline of the activities required and specific target dates to meet major steps in the schedule.

A compliance schedule is often negotiated with the Industrial User to ensure that the adopted schedule is achievable. The permit writer cannot establish a schedule for compliance with a federal categorical Pretreatment Standard that extends beyond the compliance date indicated by the applicable federal categorical pretreatment regulation [40 CFR 403.12(b)(7)].

In addition, a permit compliance schedule does not relieve an Industrial User of its obligations to comply with applicable Pretreatment Standards and Requirements including the prohibitions against pass through and interference. Compliance schedules in permits to address ongoing pass through or interference issues are inappropriate. In such situations, a more immediate enforcement action, such as a Cease and Desist Order, should be issued.

Once any federally established compliance deadline for a categorical Pretreatment Standard has passed, the proper response for the Control Authority is to initiate an enforcement action that may, in appropriate instances, involve issuance of an administrative enforcement order with a compliance schedule. Of course, the permit writer may develop more stringent compliance schedules aimed at achieving compliance with federal standards before federal deadlines. Compliance schedules should contain milestone dates that reflect the shortest reasonable time in which compliance can be achieved. Finally, the Industrial User should be required to submit a progress report to the Control Authority no later than 14 days following each milestone date in the compliance schedule.

When establishing a compliance schedule for an Industrial User's permit, the permit writer should take into consideration the complexity of the improvements or actions specified as well as any seasonal factors or legal requirements that will affect the Industrial User's efforts to comply with the conditions outlined. For example, a compliance schedule requiring groundbreaking in January in areas where winter conditions could prevent such actions from taking place is not reasonable.

TABLE 9.3
EXAMPLE OF INCORPORATING A COMPLIANCE SCHEDULE IN THE SPECIAL CONDITION

Permit No. 001

Page 3-1

PART 3 - PRETREATMENT AND MONITORING FACILITIES COMPLIANCE SCHEDULE

A. To comply with the effluent limitations identified in Part 1, Section 2 C. and Section 3 A. 2 in a reasonable period, the permittee must provide necessary wastewater treatment as required by Sections 13.16.170 and 13.16.180, Code of General Ordinances, in accordance with the following schedule:

EVENT	***BY NO LATER THAN***
1) New wastewater treatment plant design completed, clarifiers ordered, and building foundation begun.	December 30, 3007
2) Submit to the City a plant management plan for control of solvents and toxic organics.	April 19, 2008
3) Pretreatment plant building essentially complete, field-erected tank external construction in place, and piping installation begun	June 30, 2008
4) Complete instillation of new sampling devices and Palmer Bowlus flume.	September 15, 2008
5) Obtain full treatment plant operational status and achieve full compliance.	February 15, 2009

No later than 14 days following each date in the above schedule, the permittee must submit to the City a progress report including, at a minimum, whether it complied with the increment of progress to be met on such date and if not, the date on which it expects to comply with the increment of progress, the reasons for delay, and the steps being taken to retum the project to the schedule established in this permit.

9.4 Additional Monitoring Requirements

The Control Authority may often incorporate special monitoring requirements into Industrial User permits. Additional monitoring may be used to confirm the presence of suspected pollutants of concern (e.g., pollutants not regulated in an Industrial User's permit).

For example, the Control Authority could impose biomonitoring or other toxicity testing to determine the effluent's toxicity. This additional monitoring could then be used to evaluate whether the permit should be revised to include additional effluent limits, to require installation of treatment technology, or to reject the wastewater entirely. Examples of additional monitoring conditions appear in Table 9.4.

As a response to noncompliance, the Control Authority may, as illustrated in Table 9.4, require Industrial Users to perform monitoring of pollutants in addition to those regulated in the permit. Thus, the special condition may trigger an increase in the user's self-monitoring frequency. The increased monitoring allows the Control Authority to detect patterns of continuing noncompliance and distinguish isolated violations from chronic noncompliance. Naturally, the increased monitoring also draws the Industrial User's attention to the problem through the additional costs incurred. It thereby could act as a deterrent to future incidents of noncompliance.

TABLE 9.4 EXAMPLES OF INCORPORATING ADDITIONAL MONITORING REQUIREMENTS IN PERMITS

EXAMPLE OF INCREASED MONITORING BECAUSE OF VIOLATIONS

Increased Sampling in Response to Noncomplying Discharge

1. Frequency of sampling and analysis must be increased according to the schedule listed below whenever a discharge in violation of City/EPA limits is detected. Only those parameters that are in noncompliance need to be analyzed during the resampling period.

Parameter	***Sample type***	***Additional no. of samples***
Metals*	One-day 24-hour flow proportional composite	One per day for 2 days
pH	Continuous	Continuous (installation of a recording device)

2. Resampling of the noncomplying parameter must begin within 48 hours or on the first available weekday representative of normal metal finishing/plating operations after a violation is discovered.
3. The results of this sampling and analysis must be reported to the City within 15 days of the sampling.

The term" Metals" is defined as chromium, copper, lead mercury, nickel, and zinc.

EXAMPLE OF SPECIAL TOXICITY MONITORING REQUIREMENT

Self-Monitor Requirements

A. Sampling and Analysis for Clarifier Discharge Criteria			
Parameter	***Sample location***	***Sample type***	***Frequency***
COD	Clarifier effluent	Composite	Daily
Electrolytic Respirometer (six-hour duration)	Clarifier effluent	Composite	Daily
pH	Clarifier effluent	Grab	Daily

B. Electrolytic Respirometer Methodology

The Electrolytic Respirometer (ER) testing procedure as described in Attachment A will be used. Such a procedure may be reasonably modified by mutual agreement if the facility demonstrates that a more suitable testing procedure is available.

1. Initial ER testing should be set up by midnight with a normal run, including purge, lasting until 7:00 a.m.
2. When obvious ER failure is noticed, the test should be halted and a new one started immediately.
3. If the second ER meets the accepted standard, clarifier discharge can begin. The test should be run to completion and the City notified of results within 6 hours.
4. Although discharge can begin after the initial ER test, discharge can be stopped by the City.
5. If ER failure occurs, contact the City immediately at the following 24-hour emergency number [123-345-6789].

9.5 Special Conditions for Zero-Discharge Permits

The federal regulations at 40 CFR 403.3(v)(2) state that the Control Authority, under defined circumstances, may classify a facility that is subject to categorical Pretreatment Standards and therefore an SIU as an NSCIU. The conditions for classification as an NSCIU are discussed in Section 7.2.4. The NSCIU would not be subject to the requirement for control through a permit or other individual control mechanism.

A Control Authority may choose to regulate zero-discharging NSCIUs with a zero-discharge permit. Before issuing a zero-discharge permit, the Control Authority should determine the facility's potential for discharge. Considerations for *potential* are discussed in detail in Section 3.2 of this manual.

At a minimum the facility's permit should contain the following conditions:

- A statement indicating that no discharge of process wastewater is permitted.
- Requirements to notify the POTW of any changes resulting in a potential for discharge.
- Requirements to certify periodically that no discharge has occurred.
- Notice that the POTW may inspect the facility as necessary to assess and assure compliance with the no-discharge requirement.
- Requirement to comply with Resource Conversation and Recovery Act (RCRA) and state hazardous waste regulations regarding the proper disposal of hazardous waste.

The permit writer should keep in mind that there are federally regulated industries that must not discharge any process wastewater pollutants because of the industries' categorical classification. Appendix G (Summary of Industrial Sectors with Categorical Pretreatment Standards and Requirements) identifies specific no-discharge requirements for categorical facilities. The permit should clearly identify the process wastewater or pollutants or both that are prohibited from being discharged.

In addition, specific reporting frequencies are established for SIUs, CIUs, and NSCIUs. Therefore, the permit writer should review these reporting frequencies and include the appropriate reporting requirements specific to each zero-discharging facility.

9.6 Documentations of Permit Decisions

After the permit has been drafted, the permit writer should create a permanent record of the procedures followed and the basis for the decisions made during the permitting process. Although such documentation might initially seem an unnecessary and a time-consuming task, it will inevitably play a critical role in any permit challenge, and, in the long run, it can save the permit writer a great deal of time and effort.

After the permit has been drafted, the permit writer should create a permanent record of the procedures followed and the basis for the decisions made during the permitting process. Although such documentation might initially seem an unnecessary and a time-consuming task, it will inevitably play a critical role in any permit challenge, and, in the long run, it can save the permit writer a great deal of time and effort.

Some of the principal reasons for documenting permit decisions are the following:

- To remind the permit writer of the basis of the previous permit
- To document that permit conditions were developed in a reasonable, non-arbitrary manner and in accordance with proper procedures
  - Categorical classification rationale (e.g., PSES and PSNS applicability)
  - Determination of appropriate sampling location(s)
  - Production-basis and flow rates for calculating alternative limits
  - Rationale for any applicable BMPs
  - Compliance history
  - The basis for increased or decreased sampling frequency
  - The basis of pollutants to be monitored
  - Rationale for slug discharge control requirements
- To streamline future permitting issuances through the creation of a complete file containing all information used in developing previous permits that need to be revised only if circumstances change
- To create a permanent record of permit development
  - In case personnel changes occur
  - For institutional memory
  - As an explanation of permit conditions to other personnel within the pretreatment staff or in the event that the Control Authority and the permittee disagree on the meaning of particular permit conditions
- To explain permit conditions and their basis to the Industrial User and to the public
- To ensure any permit modifications are adequately documented
- To identify operating condition changes at the permittee's facility that could result in a permit modification
- To satisfy possible Approval Authority requirements for documentation of permitting rationale

9.7 Permit Fact Sheet

The basis for decisions made during the permitting process are generally summarized in a document commonly referred to as the *permit fact sheet*. This section briefly sets forth the significant factual, legal, procedural, and policy questions considered in preparing the permit. In addition, the fact sheet should summarize the findings of review of the application, inspections, and other materials necessary to describe the rationale for the conditions imposed in the control mechanism. The fact sheet should be kept attached to a copy of the permit in the Control Authority's files. The components of a fact sheet are presented in Table 9.7, and an example is in Appendix E.

TABLE 9.7 Components of a Permit Fact Sheet

1. Brief description of Industrial User, including the following:

- Name, address, and location of the facility
- Number of connections that the facility has to the sewer system, specifying the one(s) relevant to the fact sheet
- Type of operations in which the facility is engaged (e.g., manufacture of battery terminals)
- Brief description of the plant processes or other sources of generating wastewater
- Categorical determination (if applicable).
- List of raw materials used
- Description of treatment processes (if applicable), including any O&M requirements
- Description of sampling location

2. Type and quantity of the discharge:

- Rate or frequency of the discharge; the average and maximum daily flow
- Daily maximum and monthly average discharge of any pollutants present in significant quantities or subject to limitations or prohibition

3. Basis for the permit limits, including the following:

- Permit application documents
- Analytical data for pollutants provided in both a complete and summary form so that they can be easily reviewed and verified
- Copies of or citations to federal, state, and local regulations
- Copies of literature information where used to develop the permit limits (e.g., pages from the development documents)
- Plant layouts and process and wastewater flow diagrams.

4. Detailed discussion of any special conditions in the permit and the rationale for pollutant selection and limits development, including the following:

- Rationale for any monitoring waivers (e.g., pollutant not present), if applicable
- Rationale for reduced monitoring, if applicable
- Classification of NSCIU, if applicable
- Equivalent limits, if established
- Coverage under a general control mechanism, if applicable

5. Calculations showing the actual numbers used to derive each limit, including the following:

- Combined wastestream formula or flow-weighted average calculations
- Equivalent mass or concentration-based limits calculations
- Local limits allocation basis

Because permit fact sheets are not a binding part of the permit, any permittee requirements must be included in the permit for the requirement to be enforceable. The permit fact sheet should specify only the rationale as to why requirements were incorporated into the permit.

9.8 Permit Record

The permit writer should document all verbal discussions with the public and permittee and to keep copies of all correspondence exchanged. For example, an Industrial User might not be able to measure the flow of wastewater discharged to the POTW at the time of permit application or could be measuring the flow after it is combined with non-process wastestreams. The permit writer and the user might agree upon mutually acceptable wastewater flows to be used in developing the effluent limits. Such discussions and decisions should be documented. The Control Authority should establish a file in which all records pertaining to the development and issuance of the permit are kept.

Relevant documents to include in this file are the following:

- The completed permit application
- Baseline monitoring report, if applicable
- Draft permit and fact sheet
- All correspondence and data relating to the development of the permit
- Decisions regarding monitoring waivers, equivalent and alternative limits, general control mechanism coverage, NSCIU status, and reduced monitoring
- Record of any telephone conversations with interested parties concerning the permit
- Record of any public hearing or meetings
- Copies of all comments received
- Copies of all replies or responses to comments received

Topic 9 - Standard and Special Conditions Section Post Quiz

Industrial User's Permit

1. Standard conditions outline the general duties and responsibilities of each Industrial User. The order, language, and format of the standard conditions in permits are a matter of the _________________.

2. The Control Authority should have its attorney review the conditions before they are used in permits to ensure that there is adequate authority in the sewer use ordinance for each provision and that they are understandable and_________________.

3. The Control Authority can also condense or expand provisions from its sewer use ordinance and use them as ____________________ as long as the conditions in the control mechanism are consistent with the provisions in the sewer use ordinance.

Some of the standard conditions ordinarily contained in an Industrial User's permit are below.

4. Definitions of terms used in the permit. Terms that might need to be defined include composite and grab samples; instantaneous measurement; 4-day average, monthly average, or 30-day average; slug discharge; and_____________________.

5. The Industrial User's duty to comply with all provisions of the permit and the local sewer use ordinance, including the duty to comply with the ______________________. (In some cases, the general discharge prohibitions may be included verbatim as a separate standard condition.)

6. The Industrial User's duty to comply with all applicable federal Pretreatment Standards including those that become effective during the term of the permit and that compliance with the permit is not a defense for__________________.

7. The Industrial User's duty to provide information to the _______________. Within a reasonable time, the Industrial User is required to submit any information that the Control Authority may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this permit or to determine compliance with this permit.

8. The Industrial User's duty to mitigate or __________________to lessen the duration and severity of any permit violation.

9. The POTW's authority to modify or revise _______________at any time during the permit's effective term if certain conditions (such as new information, new federal standards, or evidence of fraud in the permit application) arise.

10. Notice that the permit does not convey ______________of any sort, or any exclusive privilege.

11. Need to halt or reduce activity not a defense. It must not be a defense for an Industrial User in an enforcement action that it would have been necessary to halt or reduce the permitted activity to maintain_________________.

12. Notice that the permit can be revoked if violations of permit conditions or local ordinances are identified or the _________________by the Industrial User is determined.

13. Nontransferability of the permit if there is a change of owner or operator. The permit is issued to a specific entity and cannot be transferred by_________________.

14. Which of the following terms provided to the Industrial User within a limited period after permit issuance after which the right to challenge or appeal administratively or in a court of law is deemed waived?

15. A severability clause that allows the remaining parts of a permit to remain in force if any portion of the permit is found invalid and subsequently is suspended or _____________ .

16. _______________ or duty to reapply for a new permit before expiration of the current permit.

17. Provisions requiring the installation and proper operation and maintenance of _________________by the Industrial User, including proper calibration and maintenance of all sampling equipment.

18. A condition that prohibits the _______________ as a partial or complete substitute for treatment of the wastewaters before discharge to the POTW.

Monitoring requirements (in addition to those specified in other portions of the permit) including:

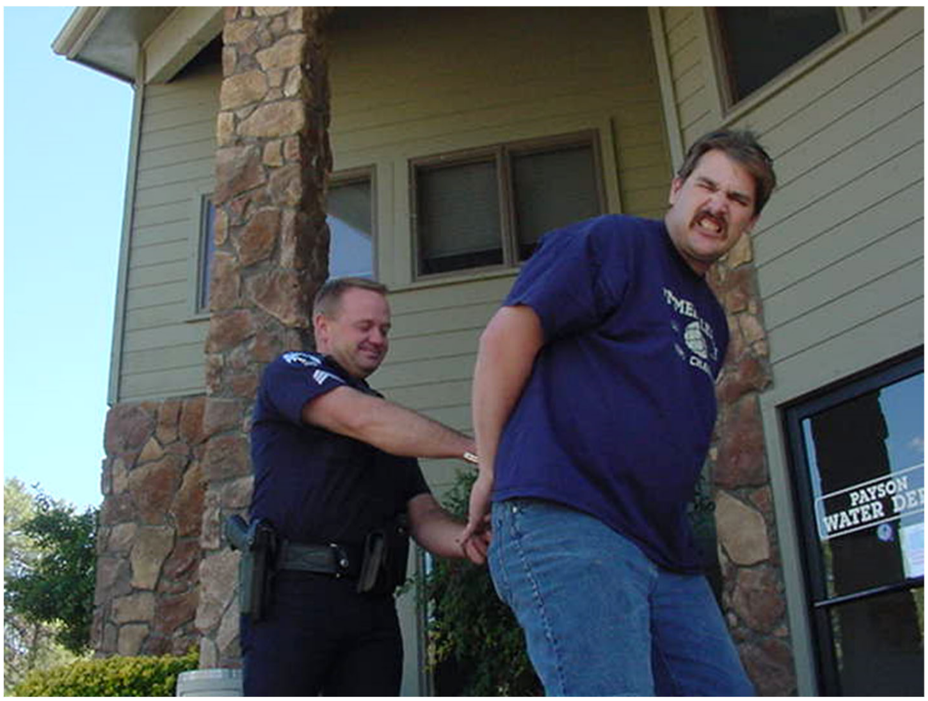
19. An outline of specific records to be maintained during ______________(i.e., name of individuals who performed the sampling; date, time, sample method used, and location of sampling; name of the individuals who performed the analysis; date and time of analyses; analytical method used; and the results of such analysis).

20. The requirement to follow ________________in 40 CFR Part 136, or other EPA-approved methods.

Topic 10 – Enforcement Section

Topic 10 - Section Focus: You will learn the basics of the pretreatment program industrial/commercial inspection, compliance and enforcement procedures along with proper documentation. At the end of this section, you will be able to understand and describe inspection and compliance procedures and proper documentation. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 10 – Scope/Background: To evaluate IU compliance, Control Authorities must first identify applicable requirements for each IU. In general, IU reports and POTW monitoring activities are the basis for POTW evaluation of IU compliance. Discharge permit limit exceedances, discrepancies, deficiencies, and lateness are all violations that must be resolved.



10.1 IU Compliance and Enforcement

In addition to requirements for permitting, sampling, and inspecting IUs, the General Pretreatment Regulations also require Control Authorities to review IU reports and plans, and respond to instances of IU noncompliance in a timely, fair, and consistent manner. Enforcement of pretreatment requirements is a critical element of the Pretreatment Program, but in the past extenuating circumstances may have prevented POTWs from taking adequate enforcement.

For example, political and economic pressures from local officials could keep POTW personnel from taking appropriate actions. After this was identified as a major concern, the EPA promulgated regulations in 1990 *(55 FR 3008*2) that require all POTWs with approved pretreatment programs to adopt and implement an Enforcement Response Plan (**ERP**).

These ERP regulations, at 40 CFR §403.8(f)(5), established a framework for POTWs to formalize procedures for investigating and responding to instances of IU noncompliance. With an approved ERP in place, POTWs can enforce against IUs on a more objective basis and minimize outside pressures.

10.2 IU Compliance

To evaluate IU compliance, Control Authorities must first identify applicable requirements for each IU. In general, IU reports (discussed in Chapter 5) and POTW monitoring activities are the basis for POTW evaluation of IU compliance. Discharge permit limit exceedances, discrepancies, deficiencies, and lateness are all violations that must be resolved.

To ensure enforcement response is appropriate and the Control Authority actions are not arbitrary or capricious, the EPA strongly recommends that an Enforcement Response Guide (**ERG**) be included as part of the approved ERP. The ERG identifies responsible Control Authority officials, general time frame for actions, expected IU responses, and potential escalated actions based on:

- The nature of the violation
- Pretreatment standards
- Reporting (late or deficient)
- Compliance schedules
- Magnitude of the violation
- Duration of the violation
- Frequency of the violation (isolated or recurring)
- (potential) impact of the violation (e.g., interference, pass through, or POTW worker safety)
- Economic benefit gained by the violator
- Attitude of the violator

10.3 How Complete is Your ERG?

Q: Is a Control Authority response required for all violations identified?

Q: Is the IU notified by the Control Authority when a violation is found?

Q: Is the IU required to respond to each violation with an explanation and, as appropriate, a plan to correct the violation within a specified time period?

Q: Where noncompliance continues and/or the IU response is inadequate, does the Control Authority's response become more formal and commitments (or schedules, as appropriate) for compliance established in an enforceable document?

Q: Is the enforcement response selected related to the seriousness of the violation?

Q: Where the violation constitutes SNC, and is ongoing, is the minimum response an administrative order?

The types of questions that dictate whether an ERP is adequate are presented above. Factors that should be considered in determining appropriate enforcement responses to noncompliance events are discussed in detail in the EPA's 1989 *Guidance for Developing Control Authority Enforcement Response Plan*s.

The General Pretreatment Regulations set as an enforcement priority, facilities that meet the criteria for "***Significant Noncompliance*** (**SNC**)" as defined in 40 CFR §403.8(f)(2)(vii). A decision to seek formal enforcement is generally triggered by an unresolved instance of SNC, failure to achieve compliance in a specified time period through less formal means, or the advice of legal counsel.

SNC evaluations are to be conducted in six-month increments; names of IUs found to be in SNC must be published in the local newspaper.

Formal enforcement must be supported by well-documented records of the violations and of any prior efforts by the Control Authority to obtain compliance. Where effluent limitations have been exceeded, records must be reviewed to verify compliance with 40 CFR Part 136 test methods. If the IU has received conflicting information from the Control Authority regarding its compliance status, its status must be clarified in writing.

Although not required, the Control Authority may consider a "**show cause**" meeting with the IU before commencing formal enforcement action. Similarly, the regulations do allow, in certain instances, an affirmative defense for violations.

The range of enforcement mechanisms available to a Control Authority depends on the specific legal authorities it has been given by city, county, and State legislatures. These mechanisms may range from a simple telephone call to suits seeking significant criminal penalties. Common enforcement mechanisms include:

Informal notice to IU - This may consist of a telephone call or "***reminder***" letter to an appropriate IU official to notify them of a minor violation and to seek an explanation.

Such informal notice may be used to correct minor instances of noncompliance.

Criminal Prosecution

This type of enforcement is a formal judicial process where sufficient admissible evidence exists to prove beyond a reasonable doubt that a person has willfully or negligently violated pretreatment standards or that a person has knowingly made a false statement regarding any report, application, record, or other document required by the General Pretreatment Regulations.

As noted above, Control Authorities must have the legal authority to seek or assess civil or criminal penalties of at least $1,000 per day for each violation. Examples of criminal violations include falsification of data and tampering with sampling results or equipment.

Termination of Service (Revocation of Permit)
These actions may be pursued by Control Authorities to immediately halt an actual or threatened discharge to the POTW that may represent an endangerment to the public health, the environment, or the POTW. Use of these remedies may also be used in bringing recalcitrant users into compliance.

Regardless of the response taken, the Control Authority should document and track all contact, notices, and meetings with IUs and IU responses. Control Authority responses and IU responses (or lack thereof) should be documented and include a record of any direct contact with the IU to attempt to resolve the noncompliance.

Control Authorities must take timely and effective enforcement against violators. Unresolved IU noncompliance may result in the Approval Authority enforcing directly against the IU and/or the Control Authority. The EPA may also take enforcement action where it deems action by the State or the Control Authority is inappropriate. An Approval Authority will routinely review the overall performance of a Control Authority in monitoring IUs, identifying violations, and in enforcing regulations.

Performance will be evaluated based on POTW self-monitoring data, written enforcement response plans, audits, inspections, and pretreatment program reports. Therefore, it is essential for Control Authorities to effectively manage program information to demonstrate proper implementation.

Section 505 of the CWA allows citizens to file suit against a Control Authority that has failed to implement its approved pretreatment program as required by its NPDES permit. The Control Authority may be fined as well as required to enforce against violations of pretreatment standards and requirements in a court order.

Administrative Tools

Informal meetings - Used to obtain an IU's commitment to comply with their pretreatment obligations or to inform the IU of stronger enforcement mechanisms available for unresolved and/or continued, noncompliance.

Warning letter or Notice of Violation (NOV) - Written notice to the IU in response to a violation of pretreatment standards or requirements. These notices should request an explanation of the noncompliance and measures that will be taken to eliminate future violations.

Administrative orders and compliance schedules - These require an IU to "**show cause**" to the Control Authority as to why formal enforcement action should not be taken and/or sewer service discontinued, or actions that will be taken to comply with pretreatment standards or requirements. Orders as such may be negotiated (i.e., Consent Order) or issued at the reasonable discretion of the Control Authority (i.e., Compliance Order).

For more egregious or serious violations, the Control Authority may issue a Cease and Desist Order.

Administrative fines - Assessed by Control Authorities against IUs for violations and intended to recapture partial or full economic benefit for the noncompliance and to deter future violations.

Civil suits - Formal process of filing lawsuits against IUs to correct violations and to obtain penalties for violations. Civil penalty amounts are generally limited through State or municipal laws. However, 40 CFR §403.8(f)(1)(vi) requires that Control Authorities have the legal authority to seek or assess civil or criminal penalties of at least $1,000 per day for each violation.

A civil suit for injunctive relief may be used when the IU is unlikely to successfully execute the steps that the Control Authority believes are necessary to achieve or maintain compliance, when the violation is serious enough to warrant court action to deter future similar violations, or when the danger presented by an IU's lengthy negotiation of a settlement is intolerable.

NOTE: Surcharges are not penalties or fines. Surcharges are intended to recoup the cost of treatment of wastes by the POTW and must not be used to allow discharges of toxic pollutants that cause interference or pass through.

Definition of Significant Noncompliance (SNC) An IU is in SNC if its violation meets one or more of the following criteria (40 CFR 403.8(f)(2)(vii):
(A) Chronic violations of wastewater discharge limits, defined here as those in which sixty-six percent or more of all of the measurements taken during a six-month period exceed **(by any magnitude)** the daily maximum limit or the average limit for the same pollutant parameter;
(B) Technical Review Criteria (TRC) violations, defined here as those in which thirty-three percent or more of all of the measurements for each pollutant parameter taken during a six-month period equal or exceed the product of the daily maximum or the average limit multiplied by the applicable TRC (TRC = 1.4 for BOD 5 , TSS, fats, oil, and grease, and 1.2 for all other pollutants except pH);
(C) Any other violation of a pretreatment effluent limit (**daily maximum or longer-term average**) that the Control Authority determines has caused, alone or in combination with other discharges, interference or pass through (including endangering the health of POTW personnel or the general public);
(D) Any discharge of a pollutant that has caused imminent endangerment to human health, welfare or to the environment or has resulted in the POTW's exercise of its emergency authority under 40 CFR § 403.8(f)(1)(vi)(B) of this section to halt or prevent such a discharge;

(E) Failure to meet, within 90 days after the schedule date, a compliance schedule milestone contained in a local control mechanism or enforcement order for starting construction, completing construction, or attaining final compliance;
(F) Failure to provide, within 30 days after the due date, required reports such as baseline monitoring reports, 90-day compliance reports, periodic self-monitoring reports, and reports on compliance with compliance schedules;
(G) Failure to accurately report noncompliance;
(H) Any other violation or group of violations which the Control Authority determines will adversely affect the operation or implementation of the local pretreatment program.

ENFORCEMENT RESPONSE PLAN EVALUATION CHECKLIST

Name of POTW:	Date of Review:

Requirement	YES	NO	N/A	Section Reference
A. Does the Enforcement Response Plan (ERP) describe how the POTW will investigate instances of noncompliance?				
1. Does it indicate that inspections and sampling will be used as a means to identify IU noncompliance?				
2. Does it indicate that inspections and sampling will be used as a means to follow-up on IU noncompliance?				
3. Does it identify personnel responsible for conducting inspections and sampling?				
4. Does it identify personnel responsible for entering inspection and sampling results into the IU's file?				
5. Does it specify time frames for entering inspection and sampling data?				
6. Does it describe procedures for tracking and reviewing (including evaluating report completeness and accuracy) all IU reports and notifications?				
7. Does it specify personnel responsible for reviewing reports and notifications?				
8. Does it specify personnel responsible for recommending enforcement action?				
9. Does it describe procedures for tracking responses to enforcement actions?				
10. Does it include appropriate procedures for determining violations and calculating SNC based on continuous pH monitoring?				
11. Does it clearly indicate the enforcement response that will be taken in response to SNC, including causing interference, pass through, filing late reports, etc.?				
12. Does it indicate that the POTW will respond to instances of SNC with an enforceable order within 30 days of identification?				
B. Does the ERP describe the types of escalating enforcement responses the POTW will take in response to all anticipated types of violations?				
1. Does it identify all possible types of noncompliance, including:				
a. Discharge without a permit (no harm)				
b. Discharge without a permit (harm)				
c. Failure to renew permit				

Requirement	YES	NO	N/A	Section Reference
d. Isolated violations of discharge limit (no harm)				
e. Isolated violations of discharge limit (harm)				
f. Recurring violation of discharge limit (no harm)				
g. Recurring violation of discharge limit (harm)				
h. Reported slug load (no harm)				
i. Reported slug load (harm)				
j. Late report				
k. Report is incomplete				
l. Failure to monitor all regulated pollutants				
m. Report is improperly signed or certified				
n. Failure to submit a report or notice				
o. Falsification of data				
p. Use of improper sampling procedures				
q. Failure to install monitoring equipment				
r. Missed compliance schedule milestones (no effect on final compliance date)				
s. Missed compliance schedule milestones (effect on final compliance date)				
t. Use of dilution instead of treatment				
u. Failure to properly operate and maintain pretreatment equipment				
v. Denial of entry to POTW personnel				
w. Failure to maintain records				
x. Failure to report additional monitoring				
2. Does the ERP reflect the full range of enforcement responses that are allowed under State law and the POTW's sewer use ordinance?				
3. Does the POTW's sewer use ordinance provide adequate legal authority for all enforcement actions the POTW proposes to initiate?				
4. When identifying appropriate enforcement actions, does the ERP allow for consideration of the following factors?				
a. Magnitude of the violation				
b. Duration of the violation				
c. Effect on receiving water				
d. Effect on POTW				
e. IU's compliance history				
f. IU's good faith				

Requirement	YES	NO	N/A	Section Reference
5. Does the ERP adequately describe procedures for escalating enforcement responses?				
6. Does the ERP include associated time frames for all activities including data review, initial and escalated enforcement actions, and follow-up actions?				
7. Does the ERP indicate that data will be reviewed no later than 5 working days after its receipt?				
8. Does the ERP indicate that initial enforcement actions will be taken no more than 30 days after detection of a violation?				
9. Do the proposed time frames in the ERP for initial enforcement actions make sense? For example, will NOVs be issued more promptly than more stringent enforcement action?				
10. Does the ERP allow for strong enforcement action to be taken immediately in the event of a major violation?				
11. Does the ERP indicate that initial follow-up compliance activities (e.g., inspections, sampling) will occur no later than 30 to 45 days after taking initial enforcement action?				
12. If the violation persists, does the ERP specify that escalating enforcement actions will be taken 60 to 90 days after the initial enforcement action?				
C. Does the ERP identify by title the persons responsible for each enforcement response?				
1. Are the positions described in the ERP consistent with those described in the POTW's program implementation procedures and sewer use ordinance?				
2. Do the positions identified in the ERP allow enforcement actions to be initiated in a timely and effective manner?				
D. Is the POTW's responsibility to enforce all pretreatment standards and requirements reflected in the ERP?				
1. Do the enforcement procedures in the ERP allow for final resolution of noncompliance? For example, is there a procedure to ensure that the same enforcement action will not be taken again and again without final resolution?				
2. Are the procedures identified in the ERP consistent with those contained in the program implementation procedures and sewer use ordinance?				

Requirement	YES	NO	N/A	Section Reference
E. In general, are the relevant elements of the ERP referenced and incorporated into other sections of the implementation manual?				

GRAB SAMPLE

A sample which is taken from a water or wastestream on a one-time basis with no regard to the flow of the water or wastestream and without consideration of time. A single grab sample should be taken over a period of time not to exceed 15 minutes.

Data Management and Recordkeeping

Any IU subject to pretreatment program reporting requirements is required to maintain records resulting from monitoring in a readily accessible manner for a minimum of 3 years (longer if during periods of any ongoing litigation). While the means for maintaining files is usually at the discretion of the POTW, all pretreatment activities should be documented and the documents maintained.

Types of IU records that the Control Authority should maintain ***include:***

Types of IU Records Retained

- Industrial waste questionnaire
- Permit applications, permits and fact sheets
- Inspection reports
- IU reports
- Monitoring data (including laboratory reports)
- Required plans (e.g., slug control, sludge management, pollution prevention)
- Enforcement activities
- **All** correspondence to and from the IU
- Phone logs and meeting summaries.

Types of POTW Records Retained

- Legal authority (e.g., SUO)
- Program procedures
- Program approval and modifications
- Copy of POTW NPDES permit(s)
- Local limits development
- ERP
- Correspondence to and from the EPA/State
- Annual reports to the Approval Authority
- Public notices
- Funding and resource changes
- Applicable Federal and State regulations
- IU compliance and permitting records

Tracking due dates, submissions, deficiencies, notifications, etc. and calculating effluent limitation noncompliance may be facilitated by a computerized data management system. Similarly, many Control Authorities use standardized forms (e.g., inspection questionnaires, chains-of-custody, field measurement records) and procedures (e.g., sampling, periodic compliance report reviews) to promote consistency and organization of program data.

In addition to specific IU records, Control Authorities should also maintain general program files that document specific program development and implementation activities that are not IU-specific. All information should be filed in an orderly manner and be readily accessible for inspection and copying by the EPA and State representatives or the public.

The pretreatment regulations specify that all information submitted to the Control Authority or State must be available to the public without restriction, except for confidential business information.

Substantial Modifications of POTW

Pretreatment Programs (40 CFR §403.18)
1. Modifications that relax POTW legal authorities (as described in 40 CFR §403.8(f)(1)), except for modifications that directly reflect a revision to 40 CFR Part 403, and are reported pursuant to 40 CFR §403.18(d) - Approval procedures for nonsubstantial modifications;
2. Modifications that relax local limits, except for modifications to local limits for pH and reallocations of the Maximum Allowable Industrial Loading of a pollutant that do not increase the total industrial loadings for a pollutant, which are reported pursuant to 40 CFR §403.18(d) - Approval procedures for nonsubstantial modifications;
3. Changes to POTW's control mechanism, as described in 40 CFR §403.(f)(1)(iii);
4. A decrease in the frequency of self-monitoring or reporting required of industrial users;
5. A decrease in the frequency of industrial user inspections or sampling by the POTW;
6. Changes to the POTW's confidentiality procedures; and
7. Other modifications designated as substantial modifications by the Approval Authority on the basis that the modification could have a significant impact on the operation of the POTW's Pretreatment Program; could result in an increase in pollutant loadings at the POTW; or could result in less stringent requirements being imposed on Industrial users of the POTW.

Public Participation and POTW Reporting
Section 101(e) of the CWA establishes public participation as one of its goals, in the development, revision, and enforcement of any regulation, standard, effluent limitation, plan, or program established by the EPA or any State. The General Pretreatment Regulations encourage public participation by requiring public notices and/or hearings for program approval, removal credits, program modifications, local limits development and modifications, and IUs in SNC.

POTW pretreatment program approval requests require the Approval Authority to publish a notice (including a notice for a public hearing) in a newspaper of general circulation within the jurisdiction served by the POTW. All comments regarding the request, as well as any request for a public hearing must be filed with the Approval Authority within the specified comment period, which generally last 30 days.

The Approval Authority is required to account for all comments received when deciding to approve or deny the submission. The decision is then provided to the POTW and other interested parties, published in the newspaper with all comments received available to the public for inspection and copying.

Once a local pretreatment program is approved, the Control Authority must implement that program as approved. Before there is a significant change in the operation of a POTW pretreatment program, a program modification must be initiated. For substantial program modifications, the Control Authority is required to notify the Approval Authority of the desire to modify its program and the basis for the change. These changes become effective upon approval.

Approval Authorities (or POTWs) are required to give public notice of the request for a modification, but are not required to notify the public of the decision if no comments are received and the request is approved without changes. Nonsubstantial modifications must also be submitted to the Approval Authority for review and approval, but these changes do not require public notice.

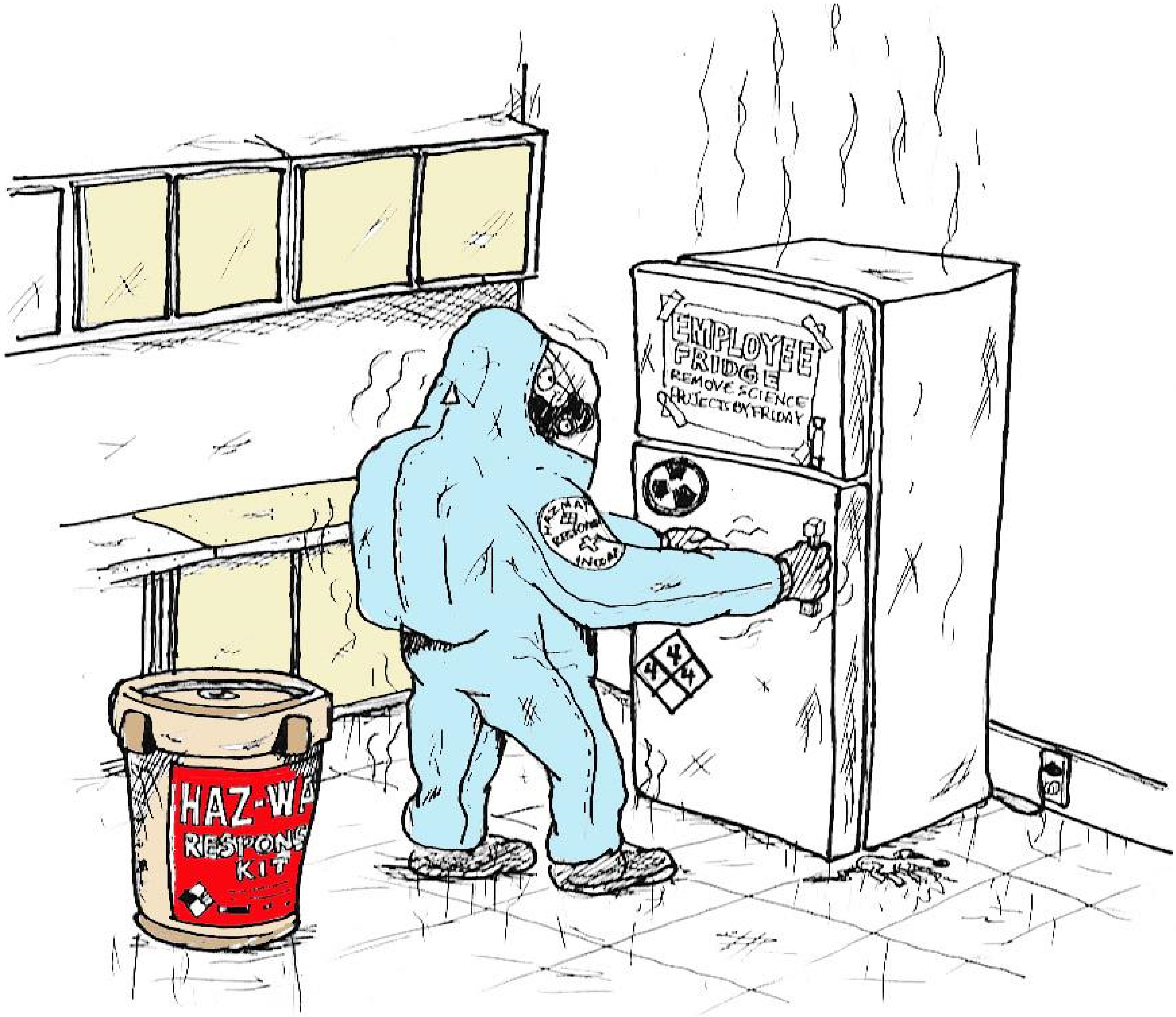
And unlike substantial modifications, nonsubstantial modifications become effective 45 days after submission unless the Approval Authority notifies the POTW otherwise.

Annual Publication

The POTW is also required to provide annual publication, in the largest daily newspaper in the municipality in which the POTW is located, of IUs that at any time during the previous twelve months were in SNC. In accordance with 40 CFR §403.12(I), Control Authorities are required to submit annual reports to the Approval Authority documenting program status and activities performed during the previous calendar year.

At a minimum, these reports must contain the following information:
1. A list of all POTW's IUs including names, addresses, pretreatment standards applicable to each user, IUs subject to categorical pretreatment standards or a brief explanation of deletions and a list of additions (with the aforementioned information) keyed to a previously submitted list;
2. A summary of the status of the IU compliance during the reporting period;
3. A summary of compliance and enforcement activities (including inspections) conducted by the POTW during the reporting period;
4. A summary of changes to the POTW's pretreatment program that have not been previously reported to the Approval Authority; and
5. Any other relevant information requested by the Approval Authority.

The first report is due within one year after program approval and at least annually thereafter. Approval Authorities may require additional information, or require that the reports be submitted in a specific format and/or at an increased frequency (e.g., semi-annually).



What are the Symptoms of Viral Gastroenteritis?

The main symptoms of viral gastroenteritis are watery diarrhea and vomiting. The affected person may also have headache, fever, and abdominal cramps ("stomach ache"). In general, the symptoms begin 1 to 2 days following infection with a virus that causes gastroenteritis and may last for 1 to 10 days, depending on which virus causes the illness.

Never keep food or drinks in your sample refrigerator. I know many of you have done this in the past and we know that special someone who works without gloves.

Guidance Manual For Implementing Total Toxic Organics (TTO)

Industrial User Pretreatment Program Responsibilities
Industrial Users (**IUs**) are required to comply with all applicable pretreatment standards and requirements. Demonstration of compliance requires certain IUs to submit reports, self-monitor, and maintain records. A summary of the reporting requirements are provided, with details of each of these requirements discussed below.

Reporting Requirements
Minimum Federal Pretreatment Program reporting requirements for IUs are specified in 40 CFR §403.12. Since Control Authorities are responsible for communicating applicable standards and requirements to IUs and for receiving and analyzing reports, it is essential for Control Authority personnel to understand IU reporting and notification requirements contained in the General Pretreatment Regulations. These requirements are summarized below.

Categorical Industrial User (CIU) Reporting Requirements
Baseline Monitoring Report (**BMR**) [40 CFR §403.12(b)]

Each existing IU that is subject to a categorical pretreatment standard (identified as a Categorical Industrial User, or CIU) is required to submit a BMR within 180 days after the effective date of the standard.

If a category determination has been requested, the BMR is not due until 180 days after a final administrative decision has been made concerning the industry's inclusion in the category. The BMR must contain the following information:

- ➢ Name and address of the facility and names of the operator and owners.
- ➢ List of all environmental control permits held by, or for, the facility.
- ➢ Description of operations, including the average rate of production, and applicable Standard Industrial.

SIC Codes
Classification (**SIC**) codes, schematic process diagrams, and points of discharge to the POTW from regulated processes:

- ✓ Flow measurements (average daily and maximum daily) for regulated process wastestreams and nonregulated wastestreams, where necessary.

- ✓ Pollutant measurements [daily maximum, average concentration, and mass (where applicable)] and applicable standards.

- ✓ Certification, by a qualified professional (reviewed by a representative of the CIU), of whether applicable pretreatment standards are being met and, if not, a description of the additional operation and maintenance (**O&M**) or pretreatment facilities that are needed to comply with the standards.

A schedule by which the IU will provide the additional O&M or pretreatment needed to comply with the applicable pretreatment standards.

BMRs

In addition to the certification noted above, BMRs must be signed and certified as detailed in 40 CFR §403.12(l) and as described later in this Chapter. If a CIU has already submitted the specific information required in a permit application or data disclosure form and this information is still current, it need not be reproduced and resubmitted in the BMR. The BMR is a one-time report, unless changed Federal categorical standards require submission of a new BMR.

At least 90 days prior to commencement of discharge, new sources are required to submit the above information (excluding the certification and compliance schedule), as well as information on the method that the source intends to use to meet the applicable pretreatment standards.

Compliance Schedule Progress Report [40 CFR §403.12(c)(3)]
A CIU that is not in compliance with applicable categorical standards by the time the standards are effective often will have to modify process operations and/or install end-of-pipe treatment to comply. Federal regulations require that the Control Authority develop and impose a compliance schedule for the CIU to install technology to meet applicable standards. As part of the BMR, a CIU that is unable to comply with the categorical standards must include a schedule for attaining compliance with the discharge standards.

In no case can the final or completion date in the schedule be later than the final compliance date specified in the categorical standards.

If deemed appropriate, the Control Authority may require compliance earlier than the final compliance date specified in the Federal regulations.

Compliance schedules are to contain increments of progress in the form of dates (not to exceed nine months per event) for commencement and completion of major actions leading to construction and operation of a pretreatment system and/or in-plant process modifications. Major activities could include hiring an engineer, completing preliminary analysis and evaluation, finalizing plans, executing a contract for major components, commencing construction, completion of construction, or testing operations.

In addition, the CIU must submit progress reports to the Control Authority no later than 14 days following each date in the compliance schedule (and final date for compliance), that include:

- A statement of the CIU's status with respect to the compliance schedule
- A statement of when the CIU expects to be back on schedule if it is falling behind, and the reason for the delay and steps being taken by the IU to return to the established schedule.

The Control Authority should review these reports as quickly as possible. When a CIU is falling behind schedule, the Control Authority should maintain close contact with the CIU. If the CIU fails to demonstrate good faith in meeting the schedule, the Control Authority may consider initiating appropriate enforcement action to correct the problem(s).

90-Day Compliance Reports [40 CFR §403.12(d) Section 403.12(d)] of the General Pretreatment Regulations requires a CIU to submit a final compliance report to the Control Authority.

An existing source must file a final compliance report within 90 days following the final compliance date specified in a categorical regulation or within 90 days of the compliance date specified by the Control Authority, whichever is earlier. A new source must file a compliance report to the POTW within 90 days from commencement of discharge.

These reports must contain:
Flow measurements (average daily and maximum daily) for regulated process wastestreams and nonregulated wastestreams, where necessary.

Pollutant measurements [daily maximum, average concentration, and mass (where applicable)] and applicable standards.

Certification, by a qualified professional, reviewed by a representative of the CIU, of whether pretreatment standards are being met and, if not, a description of the additional operation and maintenance (O&M) or pretreatment facilities that are needed to comply with the standards.

In addition to the certification noted above, 90-day final compliance reports must be signed and certified as detailed in 40 CFR §403.12(l) and as described later in this Topic section.

Definition of Upset (40 CFR §403.16)

Upset is defined as an exceptional incident in which there is unintentional and temporary noncompliance with categorical standards due to factors beyond the reasonable control of the CIU. An upset does not include noncompliance to the extent caused by operational error, improperly designed or inadequate treatment facilities, lack of preventative maintenance, or careless or improper operation.

CIUs are allowed an affirmative defense for noncompliance with categorical standards if they can demonstrate that the noncompliance was the result of an upset (Figure 31).

Conditions necessary to demonstrate an upset has occurred are detailed in 40 CFR §403.16 and require the CIU to submit at least an oral report to the Control Authority within 24 hours of becoming aware of the upset and containing the following information:

a description of the indirect discharge and the cause of the noncompliance the date(s) and times of the noncompliance steps being taken and/or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance.

If this notification is provided orally, a written report must also be submitted within five days.

In any enforcement action, the IU has the burden of proof in establishing that an upset has occurred. The EPA is responsible for determining the technical validity of this claim.

Categorical and Significant Industrial User (SIU) Reporting Requirements

Periodic Compliance Reports [40 CFR §403.12 (e) & (h)]

After the final compliance date, CIUs are required to report, during the months of June and December, the self-monitoring results of their wastewater discharge(s).

The Control Authority must also require semi-annual reporting from SIUs not subject to categorical standards. The EPA established a minimum frequency of once every six months, determining this to be adequate for small SIUs or other facilities that have little potential to cause pass-through or interference or to contaminate the sewage sludge.

Periodic Compliance Reports

The EPA assumed that larger IUs and those that have more potential to cause problems would be required by the Control Authority to sample and report more often. All results for self-monitoring performed must be reported to the Control Authority, even if the IU is monitoring more frequently than required. Periodic compliance reports must include:

- ✓ nature and concentration of pollutants limited by applicable categorical standards or required by the Control Authority.
- ✓ flow data (average and maximum daily) as required by the Control Authority.
- ✓ mass of pollutants discharged (applicable to CIUs where mass limits have been imposed).
- ✓ production rates (applicable to CIUs where equivalent limits have been imposed or where limits imposed are expressed in allowable pollutant discharged per unit of production).

A Control Authority may choose to monitor IUs in lieu of the IU performing the self-monitoring. Additionally, 40 CFR §403.12(e) and (h) require compliance with 40 CFR Part 136 (Guidelines for Establishing Test Procedures for the Analysis of Pollutants).

To demonstrate compliance with these requirements, IUs may have to submit information regarding sample handling and analytical procedures to the Control Authority.

Development of standardized forms for use by IUs and their testing labs can facilitate documentation and submission of all required information and can streamline the IU and Control Authority review process.

Bypass [40 CFR §403.17] The General Pretreatment Regulations define ***"bypass"*** as the intentional diversion of wastestreams from any portion of a user's treatment facility. If a bypass results in noncompliance, even if it was due to essential maintenance, the IU must provide a report to the Control Authority detailing a description of the bypass and the cause, the duration of the bypass, and the steps being taken and/or planned to reduce, eliminate, and prevent reoccurrence of the bypass.

Oral notice must be provided to the Control Authority within 24 hours of the detection of an unanticipated bypass, with a written follow-up due within 5 days. For an anticipated bypass, the IU must submit notice to the Control Authority, preferably 10 days prior to the intent to bypass.

Notification of Potential Problems [40 CFR §403.12(f)]

All IUs are required to notify the Control Authority immediately of any discharges which may cause potential problems. These discharges include spills, slug loads, or any other discharge which may cause a potential problem to the POTW.

Noncompliance Notification [40 CFR §403.12(g)(2)]

If monitoring performed by an IU indicates noncompliance, the IU is required to notify the Control Authority within 24 hours of becoming aware of the violation. In addition, the IU must repeat sampling and analysis, and report results of the re-sampling within 30 days.

The repeat sampling is not required if the Control Authority samples the IU at least once per month or if the Control Authority samples the IU between the time of the original sample and the time the results of the sampling are received.

Notification of Changed Discharge [40 CFR §403.12(j)]

All IUs are required to promptly notify the Control Authority in advance of any substantial changes in the volume or character of pollutants in their discharge.

Notification of Discharge of Hazardous Wastes [40 CFR §403.12(p)]

IUs discharging more than 15 kilograms per month of a waste, which if otherwise disposed of, would be a hazardous waste pursuant to the RCRA requirements under 40 CFR Part 261 are required to provide a one-time written notification of such discharge to the Control Authority, State, and the EPA.

IUs discharging any amount of waste, which if disposed of otherwise, would be an acutely hazardous waste pursuant to RCRA must also provide this notification. This written notification must contain the EPA hazardous waste number and the type of discharge (i.e., batch, continuous).

If the IU discharges more than 100 kilograms per month of the hazardous waste, the written notification must also include:

- ✓ An identification of the hazardous constituent in the IU's discharge,
- ✓ An estimate of the mass and concentration of the constituents in the IU's discharge, and
- ✓ An estimate of the mass and concentration of constituents in the IU's discharge in a year.

IUs must also provide a certification accompanying this notification that a waste reduction program is in place to reduce the volume and toxicity of hazardous wastes to the greatest degree economically practical.

Within 90 days of the effective date of the listing of any additional hazardous wastes pursuant to RCRA, IUs must provide a notification of the discharge of such wastes.

Signatory and Certification Requirements [40 CFR §403.12(l)]

Pursuant to 40 CFR §403.12(l), BMRs, 90-day compliance reports and periodic compliance reports from CIUs must be signed by an authorized representative of the facility and contain a certification statement attesting to the integrity of the information reported. The reports should be signed by one of the following:

- ✓ A responsible corporate officer if the IU is a corporation.
- ✓ A general partner or proprietor if the IU is a partnership or sole proprietorship.
- ✓ A duly authorized representative of the above specified persons if such authorization is in writing, submitted to the Control Authority and specifies a person or position having overall responsibility for the facility where the discharge originates or having overall responsibility of environmental matters for the facility.

As required in 40 CFR §403.6(a)(2)(ii), the certification statement must read as follows:
"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."

While Federal regulations only require Control Authorities to require these signatures and certifications from CIUs, many POTWs have found it important to impose these requirements for all IU reports. To facilitate compliance, many Control Authorities have developed forms that include the certification statement and signatory requirements for use by all IUs.

Self-Monitoring Requirements

All SIUs, including CIUs must conduct self-monitoring as part of several different reporting requirements as noted above. For CIUs, this includes the BMR, 90-day compliance report and periodic compliance reports (40 CFR §§403.12(b),(d), and (e), respectively). Non-categorical SIUs are required to self-monitor as part of the periodic reporting requirements (40 CFR §403.12(h)). As noted in 40 CFR §§403.12(g)(4), sample collection and analysis for all required pretreatment program reports must be conducted using 40 CFR Part 136 procedures and amendments thereto.

Refer to the EPA's 2017 *Industrial User Inspection and Sampling Manual for POTWs* for additional information on sample collection and analysis procedures.

Based on the specific pollutants regulated by categorical standards, different types of samples may have to be collected. For BMR and 90-day compliance reports, a minimum of four grab samples must be collected for pH, cyanide, total phenols, oil and grease, sulfide, and volatile organics.

If these pollutants are not regulated by the specific categorical standard, monitoring is not required. Twenty-four hour flow-proportional composite samples must be collected for all other pollutants. The Control Authority may waive flow-proportional composite sampling if an IU demonstrates that flow-proportional is not feasible. In these cases, time-proportional composite samples may be collected.

Self-monitoring for periodic compliance reports must be conducted in accordance with the IU's discharge permit requirements. The Control Authority must ensure that these permits specify sampling location(s), required sampling frequencies, sample types to be collected, sampling and analytical procedures (40 CFR Part 136), and associated reporting requirements. At a minimum, CIUs must monitor for all categorically regulated pollutants at least once every six months, although permits issued by the local Control Authority may require more frequent monitoring.

TTO

In certain instances, CIUs subject to TTO standards may implement alternatives in lieu of monitoring all regulated toxic organic compounds.

TOMP

For example, the electroplating and metal finishing standards allow IUs to monitor only for those toxic organic compounds that are reasonably expected to be present. Additional TTO guidance related to the electroplating and metal finishing categories can be found in the EPA's 1984 *Guidance Manual for Electroplating and Metal Finishing Pretreatment Standard*s.

For certain industries (i.e., electroplating, metal finishing, and electrical and electronic components) Control Authorities have the option of allowing the CIU to prepare and implement a Toxic Organic Management Plan (**TOMP**) in lieu of periodic monitoring.

In those instances, the TOMP should identify all potential sources from which toxic organic materials could enter the wastestream and propose control measures to eliminate the possibility. Where a TOMP is allowed, an IU can demonstrate compliance through adherence to the TOMP and submission of periodic certification statements attesting to the fact that: *"no dumping of concentrated toxic organic pollutants has occurred and that the facility's TOMP is being implemented."*

TOMPs cannot be used in lieu of monitoring for BMRs and 90-day compliance reporting requirements. The categorical standards for some industries (i.e., aluminum forming, copper forming, coil coating, and metal molding and casting) allow IUs to monitor oil and grease (**O&G**) as an alternative to TTO monitoring.

This option may be used to fulfill TTO monitoring requirements of the BMR, 90-day compliance report, and periodic compliance reports and allows the IU to determine whether it wants to demonstrate compliance with the TTO or the O&G standards. A detailed description of TTO monitoring requirements is provided in the EPA's 1985 *Guidance Manual for Implementing Total Toxic Organics (TTO) Pretreatment Standard*s.

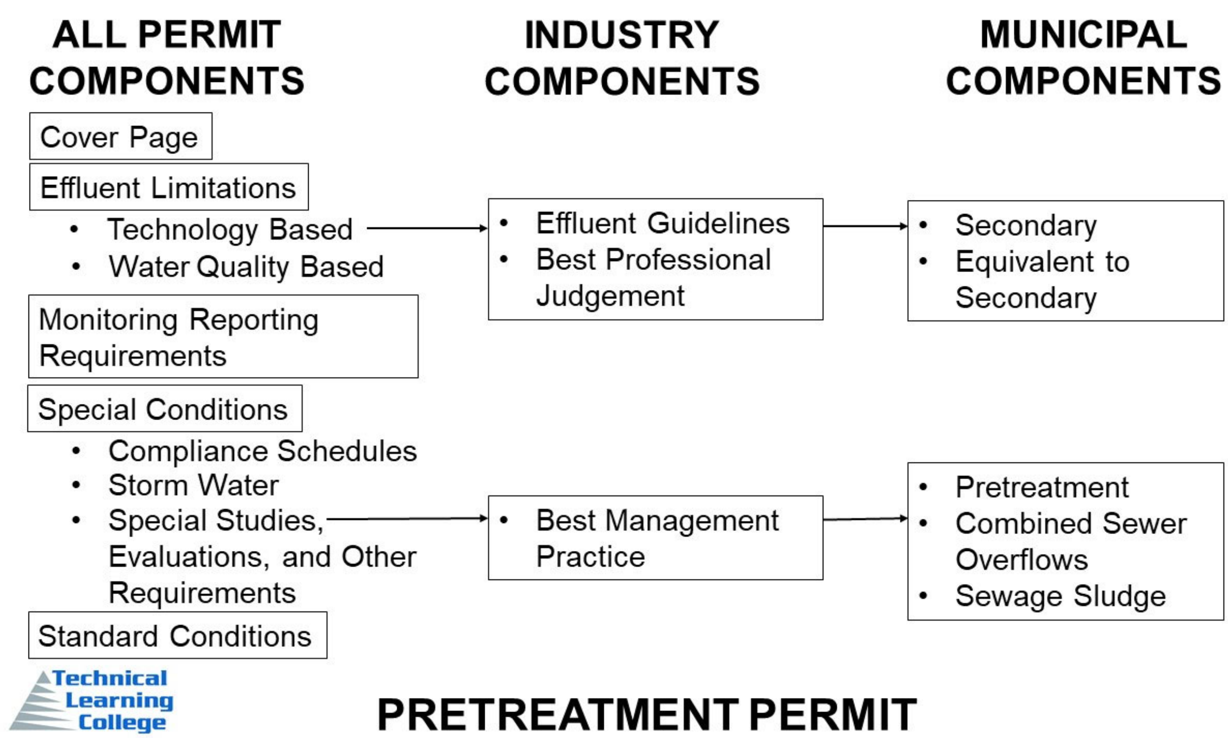
Recordkeeping Requirements

IUs are required to maintain records of their monitoring activities [40 CFR §403.12(O)]. Information, at a minimum, shall include the following:

- ✓ sampling methods, dates and times,
- ✓ identity of the person(s) collecting the samples and of the sampling location(s),
- ✓ the dates the analyses were performed and the methods used,
- ✓ the identity of the person(s) performing the analyses and the results of the analyses.

These records shall be retained for at least 3 years, or longer in cases where there is pending litigation involving the Control Authority or IU, or when requested by the Approval Authority.

These records must be available to the Control Authority and Approval Authority for review and copying. Historically, most Control Authorities do not dispose of any records; rather, older records are archived at an off-site location.



Industrial User Reporting Requirements

REQUIRED REPORT AND CITATION	APPLY TO	REPORT DUE DATE	PURPOSE OF REPORT
Baseline Monitoring Report (BMR) *40 CFR §403.12(b)(1-7)*	CIUs	Existing Source - Within 180 days of effective date of the regulation or an administrative decision on category determination. New Source - At least 90 days prior to commencement of discharge.	- To provide baseline information on industrial facility to Control Authority - To determine wastewater discharge sampling points - To determine compliance status with categorical pretreatment standards
Compliance Schedule Progress Reports *40 CFR §403.12(c)(1-3)*	All IUs	Within 14 days of each milestone date on the compliance schedule; at least every 9 months.	- To track progress of the industrial facility through the duration of a compliance schedule.
90-Day Compliance Report *40 CFR §403.12(d)*	CIUs	Within 90 days of the date for final compliance with applicable categorical pretreatment standard; for new sources, the compliance report is due within 90 days following commencement of wastewater discharge to the POTW.	- To notify Control Authority as to whether compliance with the applicable categorical pretreatment standards has been achieved - If facility is noncompliant, to specify how compliance will be achieved.
Periodic Compliance Report *40 CFR §403.12(e)*	CIUs	Every June and December after the final compliance date (or after commencement of a discharge for new sources) unless frequency is increased by the Control Authority.	- To provide the Control Authority with current information on the discharge of pollutants to the POTW from categorical industries.
Notice of Potential Problems *40 CFR §403.12(f)*	All IUs	Notification of POTW immediately after occurrence of slug load, or any other discharge that may cause problems to the POTW.	- To alert the POTW to the potential hazards of the discharge.
Noncompliance Notification *40 CFR §403.12(g)(2)*	All IUs	Notification of POTW within 24 hours of becoming aware of violation.	- To alert the POTW of a known violation and potential problems which may occur.
Periodic Compliance Reports for Noncategorical Users *40 CFR §403.12(h)*	Non-Cat. SIUs	Every six months on dates specified by the Control Authority.	- To provide the POTW with current information on the discharge of pollutants to the POTW from industrial users not regulated by categorical standards.
Notification of Changed Discharge *40 CFR §403.12(j)*	All IUs	In advance of any substantial changes in the volume or character of pollutants in the discharge.	- To notify POTW of anticipated changes in wastewater characteristics and flow which may affect the POTW.
Notification of Hazardous Wastes Discharge *40 CFR §403.12(p)*	All IUs	For new discharges, within 180 days after commencement of discharge.	- To notify POTW, EPA, and State of discharges of hazardous wastes under 40 CFR Part 261.
Upset *40 CFR §403.16*	CIUs	24 hours of becoming aware of the upset (5 days where notification was provided orally)	- To notify the POTW of unintentional and temporary noncompliance with categorical standards.
Bypass *40 CFR §403.17*	All IUs	10 days prior to date of the bypass or oral notice within 24 hours of the IU becoming aware of the bypass with written notification within 5 days.	- To notify the POTW of noncompliance and potential problems which may occur

Examples of Enforcement and Regulatory Letters

____
Contact Person

____
Company Name

____
Company Address

____
________________**Date**__________
City, State, Zip

Certified Mail

Return Receipt Requested

OR

Hand Delivered

Rec'd by

Company Name

NOTICE OF VIOLATION
RE: Reporting

Wastewater Discharge Permit# _________________ (Permit issue No.) issued to______________________________ (Company Name)
requires ____ (Company Name) to submit_______________________ (Type of Report)
reports to the City of Sunflower_______________________________________ (Qualification of Report)
The report submitted by ____ (Individual or Company Name) on__________________ (Date Received by E &)
for______________________________ (Description or Violation) was due on ___________________ (Date), _______________ (Number)
days late. _________________________________ (Company Name) is therefore in violation with its permit.

_______________________________is required to submit to the Enforcement (Company Name) and Monitoring Section a written report outlining the reason(s) for failure to meet this requirement and detailing the corrective action(s) taken to prevent future violations.

This receipt must be received by______________________
Mailing date + 15 Days (ESTABLISHED BY SECRETARY)

Failure to comply with the requirements of this letter will subject____________________________ (Company Name) to further enforcement action(s). This Notice does not preclude the City from taking additional enforcement action(s) under Chapter 10 of the Sunflower City Code.

Should you have any questions regarding this Notice, please contact Water Quality Division at 474-8888. Our office hours are 7:00 a.m. to 3:30 p.m., Monday through Friday.

Sincerely,

____
Name of Inspector

____
Title

____
Department

Date

____
Representative

____
Company

____
Address

____
City, State, Zip

Dear__________________________:
Representative

Re: **NOTICE OF VIOLATION NO**. ____
Nov No. Assigned

Thank you for submitting the ____
Analysis, Report

required by the Notice of Violation (**NOV**) dated__________________________________,
Date

covering the ____violations (s).
Parameter (s)

____has met all the requirements of
Company
this Notice of Violation and no further action is required at this time. This letter does not preclude the City from taking additional enforcement action(s) under Chapter 10 of the Sunflower City Code.

Should you have any questions regarding this letter, please contact the Water Quality Division at 474-8888. Our office hours are 7:30 a.m. to 3:30p.m. Monday through Friday.

Sincerely,

____
Inspector

____
Title

NOTICE TO SHOW CAUSE

________________________________has been previously notified of ________________________ violations. In light of the pretreatment violations identified in the attached Notice)s) and in this Notice to Show Cause, the City of Sunflower, acting as the Control Authority pursuant to the legal authority established by Title 40, Code of Federal Regulations, Part 403, and in accordance with Chapter 10 of the Sunflower City Code, hereby notifies

_______________________________of its intent to utilize all appropriate

remedies to address these pretreatment violations. These remedies include monetary penalties.

Representatives from ____are required

to attend a Meeting to Show Cause to be held at:

Place: Water Quality Conference Room
POTW Waste Water Treatment Plant
8111 W. Montebello
Sunflower, AZ 85296

Date: __________, _________________

Time: _______________

During the Show Cause meeting, ______________________________________will be given the opportunity to respond to the allegations stated below and will be asked to show cause why the City should not seek monetary and / or other penalties in response to the following:

During the time period referred to above,

_____________________________ discharged in violation of its permit on at least _________ occasion(s).

A____________________ report was submitted ________days late.

A 24 Hour Notification was __________days late.

It is hereby requested that_______________________________________ have in Attendance at this meeting persons knowledgeable about the matters alleged in this Notice as well as persons having decision making authority. Your representatives may be accompanied by legal counsel if you so desire.

A representative from the City Attorney's office may be present at the meeting. Any written response to this Notice that you would like us to consider must be in my office on or before_______________.

We would appreciate if you would let us know by____________________.

A copy of the latest edition of the City's Civil Penalty Policy together with the Civil Penalty Calculation Worksheet is enclosed.

Your failure to appear will mean that the City of Sunflower will take all appropriate enforcement action it deems necessary based on the facts as outlined in this notice and attachments.

Should you have any questions regarding this notice, please contact Water Quality Division at 474-8888. Our office hours are 7:00 a.m. to 3:30 p.m., Monday through Friday.

Sincerely,

Chris Dustin,
Water Quality Supervisor

Company

Certified Mail

Hand delivered

NOTICE OF VIOLATION
RE: Permit Conditions

A review and evaluation of ___________________________'s ___________________

Report that was received on____________________________________, indicates that

your monthly analysis for____ was not included. The monthly analysis is required as indicated on your Wastewater Discharge Permit # _____________________, and also aids the City of Sunflower in determining compliance with the discharge standards.

____is therefore required to immediately

sample for _______________________and submit the analysis by _______________.

You are also required to submit a written report outlining the reason(s) for failure to meet this requirement and the corrective action(s) taken to prevent future violations.

This written report must be submitted by_________________________.

Failure to comply with the requirements of this letter will subject ___________________ to further enforcement action(s). This notice does not preclude the City from taking additional enforcement action(s) under Chapter 10 of the Sunflower City Code.

Should you have any questions regarding this notice, please contact Water Quality Division at 474-8888. Our office hours are 7:00 a.m. to 3:30 p.m., Monday through Friday.

____
Inspector

______________________________ Contact Person

______________________________ Company Name

______________________________ Company Address

______________________________ City, State, Zip

Certified Mail

Return Receipt Requested

OR

Hand Delivered

Rec'd by ______________ **Date**__________
Company Name

NOTICE OF VIOLATION

RE: Effluent Limits (City Monitoring)

The discharge to sewer from ______________________________ exceeded the maximum
Company Name

Allowable limit for ____________________as established in your Wastewater Discharge
Effluent

Permit No. __________________

Date	Parameter	Discharge Concentration	Discharge Limit

____________________________is required to submit to the Enforcement and Monitoring
Company Name

section a detailed written report outlining the reason(s) the violation(s) occurred and the corrective action taken to prevent future violations. This report (must be/was) (submitted/received) (by/on)

____
Mailing Date + 15 Days (ESTABLISHED BY SECRETARY)

Failure to comply with the requirements of this letter will subject ________________________
Company Name

to further enforcement action(s).

This Notice does not preclude the City from taking additional enforcement action(s) under Chapter 10 of the Sunflower City Code.

Should you have any questions regarding this notice, please contact Water Quality Division at 474-8888.

Our office hours are 7:30 a.m. to 3:00 p.m., Monday through Friday.

____
Name of Inspector

____
Title

Company

Re: **Wastewater Discharge Permit Renewal**

Dear:

A review of ____’s industrial waste

file indicates that your Wastewater Discharge Permit # ________________________,

for your ______________________________facility expires_____________________

In order for a valid permit to be issued, the enclosed Industrial Waste Permit Application

must be properly filled out and returned to our office by__________________________.

Should you have any questions regarding these results, please contact Water Quality Division at 474-8888. Our office hours are 7:00a.m. to 3:30p.m., Monday through Friday.

Signature

Permit Appeals Process *(Example)*

(Section 7-88- Chapter 10, Sunflower City Code)

Any Permit applicant or Permittee (aggrieved party) may petition the Director to reconsider the conditions and limitations of a Permit issued or amended under the authority of Section 28-46(a) of the Sunflower City code by filing a petition for review with the Director within twenty (20) days of receipt of the Permit.

Failure to submit a timely petition for review shall be deemed to be a waiver of the administrative appeal.

In its petition, the aggrieved party must identify the Permit provisions objected to, specify in detail the reasons for objection, and present the alternative condition, if any, it seeks to place in the Permit.

The provisions of the Permit that are not objected to shall not be stayed pending the appeal.

If the Director fails to act within 30 days from receipt of the petition, it shall be deemed to be denied. Decisions not to reconsider the issued or amended Permit, not to issue a Permit, or not to amend a Permit shall be considered final administrative actions for purposes of judicial review.

The aggrieved party seeking judicial review of the final Permit decision may file a complaint with the Superior Court for Gila County, Arizona.

The petition for review should be addressed to:

Bill Fields, Superintendent
City of Sunflower
Pollution Control Division
8111 W. Montebello Ave
Sunflower, Arizona 85629

Zero Discharge (Examples)

February 20, 2022

Mr. Mike Ploughe
Plant Superintendent
Ploughe Products
8111 West Montebello Lane
Sunflower, Arizona 85027

RE: Class B Zero Process Discharge Permit inspection conducted by the City of Sunflower Pollution Control Division on July 12, 2015.

Dear Mr. Ploughe:
As per our phone conversation of July 18, 2015, the purpose of this letter is to clarify the findings listed in the inspection report, dated July 12, 2015. In the description of findings section of the inspection report, it was noted that "All hazardous wastes are shipped off site for disposal."

During the inspection it was noted that hazardous waste were in fact shipped off site for disposal from the former Ploughe Products (PP) location at 3632 West Heidi, Sunflower, Arizona. It was also noted that since PP relocated to 8111 West Montebello Lane, Sunflower, Arizona, no hazardous waste have been shipped off site for any reason.

Please be aware that your facility may be subject to solid or hazardous waste management requirements pursuant to the Federal Resource Conservation and Recovery Act (PL 94-580 as amended) and state hazardous waste management regulations.

The attached general material describes federal requirements for hazardous waste generators and transporters. This packet includes descriptions of hazardous waste management requirements, which may apply to your operation if it involves generating or transporting hazardous waste.

In order to insure that your operation comply with federal, state, and local hazardous waste management regulations, please review the enclosed material and consult the following agencies to determine all specific requirements that apply to your operation:

U.S. EPA
RCRA/Superfund
Washington, D.C.
Information Hotline
(800) 424-9346

Mr. Patrick Kuefler
Arizona Dept. of Environmental Quality
Hazardous Waste Compliance
3033 North Central Ave
Sunflower, AZ 85012
(602) 207-4105

Should you have any questions, please contact me at 474-8888. Our office hours are 8:00 a.m. to 5:00 p.m., Monday through Friday.

Sincerely,

Bill Fields
Water Quality Inspector
Ms. Melissa Phatly July 10, 2021
Environmental/ Safety Manager
ACME Corporation
556 North 39th Avenue
Sunflower, Arizona 85093

RE: WARNER POWDER COATING FACILITY INSPECTION
556 N. 39TH AVENUE, SUNFLOWER, AZ. 85093

ACME CORPORATION FACILITY INSPECTION
4325 W. MONROE AVENUE, SUNFLOWER, AZ 85093

Dear Ms. Phatly :

Thank you again for your time and cooperation during inspection of the above-referenced facilities conducted by the City of Sunflower Pollution Control Division (PCD) on June 1, 2021. Inspection reports are attached for your information.

Based on the inspection findings and review of previously submitted Industrial Wastewater Permit Applications for both Warner Coatings and Acme Corporation (dated October 11, 2001 and January 30, 2021, respectively), PCD has determined that:

1) Warner Technical and Acme Corporation are subject to Categorical Standards for Metal Finishing, pursuant to Title 40 Code of Federal Regulations Part 433 (Metal Finishing Point Source Category, copy attached);

2) Pursuant to Sunflower City Code Chapter 28 Article VI (Industrial User and Pretreatment Requirements, copy attached), Warner Technical and Acme Corporation must obtain a Class B Zero Process Discharge Permit and a Zero Categorical Process Discharge Permit, respectively; to discharge existing process and non-process wastewater to the City sanitary sewer system.

Presently, PCD is processing a Class B Zero Categorical Process Discharge Permit for each facility. As you requested during the inspections, all future correspondence regarding Warner Technical Coatings or Acme Corporation will be directed to Able Lopez (Warner Technical Coatings Production Manager) and Willie Clinton (Acme Corporation Manufacturing Coordinator), respectively.

Should you have any questions, please contact me at 534-3681. Our office hours are 8:00 a.m. to 5:00 p.m., Monday through Friday.

Sincerely,

Bill Fields
Senior Water Quality Inspector

Topic 10 - Enforcement Post Quiz

IU Compliance and Enforcement

1. ERP regulations, at 40 CFR §403.8(f)(5), established a framework for POTWs to formalize procedures for investigating and responding to instances of ___________________.

2. With an approved ________________in place, POTWs can enforce against IUs on a more objective basis and minimize outside pressures.

IU Compliance

3. Which of the following terms, discrepancies, deficiencies, and lateness are all violations that must be resolved?

4. To ensure enforcement response is appropriate and the _________________are not arbitrary or capricious, the EPA strongly recommends that an Enforcement Response Guide (ERG) be included as part of the approved ERP.

Criminal Prosecution

5. Control Authorities must have the legal authority to seek or assess ______________of at least $1,000 per day for each violation.

6. Examples of _________________include falsification of data and tampering with sampling results or equipment.

Termination of Service (Revocation of Permit)

7. Regardless of the response taken, the Control Authority should document and track all contact, notices, and meetings with IUs and IU responses. Control Authority responses and IU responses (or lack thereof) should be documented and include a record of any direct contact with the IU to attempt to resolve the_______________.

8. Control Authorities must take timely and effective enforcement against violators. ________________ may result in the Approval Authority enforcing directly against the IU and/or the Control Authority.

9. Performance will be evaluated based on POTW self-monitoring data, written enforcement response plans, audits, inspections, and ___________________.

10. The Control Authority may be fined as well as required to enforce against violations of pretreatment standards and requirements in __________________.

Administrative Tools

11. Informal meetings - Used to obtain an IU's commitment to comply with their pretreatment obligations or to inform the IU of ________________available for unresolved and/or continued, noncompliance.

12. For more egregious or serious violations, the Control Authority may issue a _________.

13. Administrative fines - Assessed by Control Authorities against IUs for violations and intended to recapture partial or full economic benefit for the ________________________.

14. Civil suits - Formal process of filing lawsuits against IUs to correct violations and to obtain _________________.

Definition of Significant Noncompliance (SNC) An IU is in SNC if its violation meets one or more of the following criteria (40 CFR 403.8(f)(2)(vii):

15. What missing term describes wastewater discharge limits, defined here as those in which sixty-six percent or more of all of the measurements taken during a six-month period exceed (by any magnitude) the daily maximum limit or the average limit for the same pollutant parameter?

16. Technical Review Criteria (TRC) violations, defined here as those in which thirty-three percent or more of all of the measurements for each pollutant parameter taken during a six-month period equal or exceed the product of the daily maximum or the average limit multiplied by the applicable TRC (TRC = 1.4 for BOD 5 , TSS, fats, oil, and grease, and 1.2 for all other pollutants except pH).
True or False

17. Any other violation of a pretreatment effluent limit (daily maximum or longer-term average) that the Control Authority determines has caused, alone or in combination with other discharges, ____________________ (including endangering the health of POTW personnel or the general public).

18. Failure to meet, within 90 days after the schedule date, a compliance schedule milestone contained in a local control mechanism or enforcement order for starting construction, completing construction, or ______________________.

19. Any discharge of a pollutant that has caused______________, welfare or to the environment or has resulted in the POTW's exercise of its emergency authority under 40 CFR § 403.8(f)(1)(vi)(B) of this section to halt or prevent such a discharge.

20. Which of the following terms in which the Control Authority determines will adversely affect the operation or implementation of the local pretreatment program?

Topic 11 - POTW Hauled & Hazardous Wastes Requirements

Topic 11 - Section Focus: You will learn the basics of the pretreatment program POTW biosolid and hazardous waste disposal. At the end of this section, you will be able to understand and describe Clean Water Act's rule concerning proper biosolids and hazardous waste disposal. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 11 – Scope/Background: Biosolids are treated sewage sludge and regulated by 40 CFR Part 503. The general pretreatment regulations, 40 CFR Part 403 establish standards and mechanisms for responsible entities to control pollutants that might pass through or interfere with publicly owned treatment works (POTW) treatment processes or contaminate sewage sludge. Land-applied biosolids must meet strict regulations and quality standards.
.

11.1 Hauled Waste Concerns

Every hauled waste discharge has the potential to impact the POTW. Unlike discharges from IUs connected to the POTW, the makeup of a load of hauled waste is virtually unknown without some type of monitoring, be it visual or analytical. Even loads of domestic septage can cause problems at a POTW. The majority of waste haulers are reputable business people who provide a valuable service to the public and industry; however, the unique attributes of hauled waste can be devastating when unethical haulers dump incompatible wastes at POTWs.

Resource Conservation and Recovery Act Introduction

The Resource Conservation and Recovery Act (RCRA) authorizes EPA to control hazardous wastes, including the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also provides EPA a framework for managing of non-hazardous wastes. POTWs and industrial users that generate hazardous waste and POTWs accepting hazardous waste must comply with both CWA and RCRA requirements.

The Control Authority should be aware that if its treatment plant accepts hazardous wastes by truck, rail, or dedicated pipeline within the property boundary of the treatment plant(s), that POTW is a hazardous waste treatment, storage, or disposal facility (TSDF) and is subject to regulation under the Resource Conservation and Recovery Act (RCRA), 42 U.S.C. 6901 *et seq*. RCRA establishes a comprehensive program regulating the management of nonexempt hazardous wastes from the time they are generated until ultimate disposal (i.e., a *cradle to grave* management system).

Under the RCRA domestic sewage exclusion, mixtures of domestic sewage and other wastes (including hazardous wastes) that mingle in the collection system before reaching the POTW's property boundary are excluded from RCRA regulation. However, wastes that are delivered by truck, rail, or dedicated pipeline do not fall within this exclusion. Hazardous wastes received by these routes may be accepted by POTWs only if the POTWs comply with RCRA *permit-by-rule* regulations. State hazardous waste programs may also have laws governing POTWs that accept hazardous waste for treatment.

Biosolids – Sewage Sludge

Biosolids are treated sewage sludge and regulated by 40 CFR Part 503. The general pretreatment regulations, 40 CFR Part 403 establish standards and mechanisms for responsible entities to control pollutants that might pass through or interfere with publicly owned treatment works (POTW) treatment processes or contaminate sewage sludge. Land-applied biosolids must meet strict regulations and quality standards.

Biosolid Disposal

The regulations for the use and disposal of biosolids (40 CFR Part 503) specify:

- numerical limits for metals,
- pathogen reduction standards,
- site restriction,
- crop harvesting restrictions and monitoring requirements,
- record keeping and reporting requirements for land-applied biosolids, and
- similar requirements for surface-disposed or incinerated biosolids

Hauled Waste Requirements

The term "hauled waste" refers to the wastes' transportation method to the POTW. Hauled waste might be sewage or domestic waste, or it might include non-domestic waste, or a combination of both types of waste. If an IU has its wastes hauled to the POTW, the waste must still comply with its applicable pretreatment standards and requirements.

Nature of Hauled Wastes

Definition of Domestic Septage

Domestic septage is defined as either the liquid or solid material removed from a septic tank, cesspool, portable toilet, Type III marine sanitation device, or similar treatment works that holds only domestic sewage.

Domestic septage does not include liquid or solid material removed from these systems that receives either commercial wastewater or industrial wastewater and does not include grease removed from a restaurant grease trap. [40 CFR Part 503.9(f)]

In addition to receiving wastes through the collection system, many POTWs accept trucked wastes, and in a few instances, wastes received via train. As specified in 40 CFR §403.1(b)(1), pollutants from non-domestic sources which are transported to the POTW by truck or rail are also subject to the General Pretreatment Regulations.

Wastes are hauled to POTWs for several reasons. By far, the majority of hauled waste is domestic septage. Since these wastes are domestic in nature, treatment at a POTW is the most appropriate disposal method. Other types of wastes are also regularly hauled to POTWs for a variety of reasons, such as:

- ✓ the facility is located outside the jurisdictional boundaries of the POTW (e.g., located in rural areas) and is not connected to the collection system,
- ✓ the wastes may be known to cause collection system problems, but can be treated at the POTW (e.g., grease trap cleanout wastes),
- ✓ the facility is connected to the sewer but does not have the capacity to discharge the volume of waste generated (e.g., groundwater remediation activities at an IU),
- ✓ a POTW rejects acceptance of a waste from an IU forcing the IU to haul the waste to a different POTW that agrees to accept the waste.

Common to all these wastes is the fact that the POTW does not know for certain the nature and concentration of these wastes, as hauled, without implementing some type of control or surveillance program.

Hauled wastes, like wastes received through the collection system, have the potential to impact the POTW, making regulatory control of these wastes necessary. Recent studies have shown an increasing frequency of uncontrolled discharges to POTWs from waste haulers.

Because of their unique nature, waste haulers are not regulated in the same way as other types of IUs. Since no specific Federal regulatory controls exist, some POTWs have developed hauled waste control programs. For more information on hauled waste, refer to the EPA's 1998 *Guidance Manual for the Control of Waste Hauled to Publicly Owned Treatment Work*s.

Waste Control Programs

Section 403.5(b)(8) of the General Pretreatment Regulations specifically prohibits the introduction of any trucked or hauled pollutants to the POTW, except at discharge points designated by the POTW. This is the only pretreatment requirement specifically addressing hauled wastes. However, many POTWs have determined that additional controls are necessary to further limit these discharges and to prevent adverse impacts from these discharges.

These control programs include practices such as permitting, sampling, manifesting, surveillance, and other forms of hauler documentation. In many instances, these control programs have shifted the hauling of waste from one POTW to other POTWs that are not implementing such a program.

Most often, it is the smaller POTWs that do not have hauler control programs, including many POTWs that are not even required to implement Pretreatment Programs. The effect of this change from larger to smaller POTWs and from more to less control is that there has been an increase in negative impacts to POTWs and receiving streams.

Two apparent options for addressing this concern are for: (1) the smaller and non-pretreatment POTWs to initiate waste hauler control programs; or (2) the larger POTWs to institute sound control programs that will adequately regulate these wastes yet not drive these haulers to search for other less sound disposal alternatives.

POTW waste hauler control programs should address the following six elements:
Impact to POTW - Prior to acceptance of a new waste from a hauler, the POTW needs to evaluate the potential impacts to the POTW from this waste. POTWs may require haulers or generators of hauled waste to perform a treatability study to demonstrate the effectiveness of treatment on this waste. POTWs must evaluate the impacts of this waste when evaluating the adequacy of local limits as well as when developing or revising local limits.

Permitting - A permit is the most direct and efficient method of regulating waste haulers. Permits provide the opportunity to monitor and regulate haulers based on the nature of the hauled waste and the potential impacts of that waste on the POTW. Unique permit conditions may include: right of refusal, daily flow limitations, discharge time limitations, and manifesting requirements.

Discharge Point - As specified in the General Pretreatment Regulations, hauled waste can only be discharged at points designated by the POTW. This option is to provide the POTW with the ability to control and observe these discharges at specified locations, thereby minimizing the potential for adverse impacts.

Monitoring - The POTW should institute a monitoring program to evaluate the nature and concentration of discharges. Both POTW monitoring and hauler self-monitoring may be appropriate. Many POTWs require that all loads of hauled waste must be sampled, but analyses are only performed on a predetermined percentage of these wastes or when problems occur.

Unanalyzed samples are refrigerated and kept for several weeks or months until the POTW is certain that the waste has not impacted the POTW. The frequency of sampling may also be dependent on the variability of the waste. Each load from a hauler that delivers highly variable loads may have to be sampled and analyzed; whereas, a much smaller percentage may be appropriate for more consistent waste types. As noted earlier, all Federal, State, and local discharge limitations apply to these wastes. The POTW may also consider inspecting the waste generators to confirm the source of these wastes.

Hauler Documentation - The POTW should require waste haulers to document the source of wastes being discharged, potentially including manifests. Manifests should include general hauler information, information on the waste generator (e.g., name, address, and phone number), the type of wastes collected, volumes, known or suspected pollutants, and certification that the load is not a hazardous waste. A useful technique is to contact the waste generators to verify the information on the manifest.

Legal Authority - If not already in place, the POTW's local ordinance (and approved pretreatment program) should be modified to add language specifying all of the controls that are applicable to waste haulers. This will ensure that waste haulers and POTW personnel will know the procedures, expectations, liabilities, etc. associated with the control program.

In addition to the specific controls described above, POTWs should implement procedures to identify and eliminate illegal discharges. Procedures may include periodic sewer line sampling, surveillance of suspected illegal discharge points, education of industries regarding hauled waste, increased enforcement, and public awareness of illegal dumping.

RCRA Permit-by-Rule Regulations
Under RCRA permit-by-rule regulations in 40 CFR 270.60(c), the POTW would be deemed to have a RCRA permit if it meets the following conditions:

- Have and comply with the conditions of an NPDES permit [40 CFR 270.60(c)(1) and (2)]
- Apply for an EPA identification number [40 CFR 264.11]
- Use a manifest system [40 CFR 264.71]
- Reconcile manifest discrepancies with the hazardous waste generator or transporter [40 CFR 264.72]
- Keep a written operating record of hazardous wastes received and treatment, storage, and disposal methods for the hazardous wastes [40 CFR 264.73(a) and (b)(1)]
- Submit a biennial report to the Regional administrator [40 CFR 264.75]
- Submit a report to the Regional administrator notifying EPA of any unmanifested hazardous wastes at the time of receipt [40 CFR 264.76]
- Institute corrective action, as necessary, as specified in the POTW's NPDES permit (for permits issued after November 8, 1984) [40 CFR 364.101]
- Require all wastes received to meet all federal, state, and local pretreatment requirements, as if the wastes were being conveyed to the POTW by sewer, pipe, or similar conveyance [40 CFR 270.60(c)(4)]

For a discussion of the requirements, see EPA's *Guidance for Implementing RCRA Permit-by-Rule Requirements at POTWs*.

Solid Waste

A POTW can assume that it is receiving hazardous wastes by truck or rail if the wastes are accompanied by the hazardous waste manifest used in the RCRA program. If the waste hauler does not provide such a manifest, the POTW might still wish to determine if the hauled wastes are considered hazardous because RCRA responsibilities apply even if the POTW accepts such wastes unknowingly. To be considered a hazardous waste, a waste must first be considered a *solid waste* as defined in 40 CFR 261.2. To determine if a solid waste is regulated under federal regulations as a hazardous waste, the POTW must determine whether the waste in question is excluded from regulation under 40 CFR 261.4(b). If it is not excluded, the POTW must then determine whether the waste in question falls into one of the following categories:

- It is *listed* as a hazardous waste in Subpart D of 40 CFR Part 261 (unless it has been specifically delisted)
- It has not been listed, but it exhibits any of the *characteristics* of a hazardous waste described in Subpart C of 40 CFR Part 261
- It is a *mixture* of a listed waste and a nonhazardous waste or is derived from the treatment of a listed hazardous waste (unless it has been specifically excluded under 40 CFR 261.3). (Note: A mixture of a characteristic waste and a nonhazardous solid waste, or the residue from the treatment of a characteristic waste, is considered hazardous only if it exhibits one or more of the hazardous waste characteristics.)
- For more information on identifying and regulating hazardous wastes, see the following EPA guidance materials:
  - – RCRA Information on Hazardous Wastes for Publicly Owned Treatment Works
  - – *RCRA Orientation Manual* (prepared by the Office of Solid Waste)
  - – Guidance Manual for the Identification of Hazardous Waste Delivered to Publicly Owned Treatment Works by Truck, Rail, or Dedicated Pipeline
  - – Guidance for Implementing RCRA Permit-by-Rule Requirements at POTWs

POTWs can choose not to accept the delivery of hazardous wastes by truck rail or dedicated pipeline by

- Strictly prohibiting the discharge of any hauled wastes
- Prohibiting the discharge of any industrial process wastes (i.e., accepting only domestic waste from haulers or dedicated pipelines)
- Prohibiting the discharge of hazardous waste (e.g., accept hauled or dedicated pipeline industrial process wastes but only if accompanied by sufficient documentation to demonstrate that wastes are not hazardous)

Reliable monitoring must be conducted to ensure that such conditions are met. The Control Authority should evaluate each of these methods before making a decision as to which method is the most appropriate for its treatment plant. Considerations such as local community practices should be taken into account (e.g., is contract hauling of household and industrial septage wastes common in the community, or are most locations serviced by municipal sewer collection systems?).

In addition to the RCRA requirements incorporated by reference into the permit-by-rule requirements for POTWs, there might be other requirements that apply as a matter of law.

For example, sections 3004(d), (e), and (g) of RCRA prohibit the land disposal of hazardous waste in specified situations. Such requirements and others could apply to POTWs receiving hazardous waste by truck, rail, or dedicated pipeline. For other RCRA requirements that might apply to POTWs that receive hazardous wastes by truck, rail, or dedicated pipeline, see Appendix D of EPA's *Guidance for Implementing RCRA Permit-by-Rule Requirements at POTWs*.

In summary, the Control Authority should determine the applicability of RCRA requirements and responsibilities if its treatment plant accepts hauled wastes, especially if any of the hauled wastes are known or suspected to have been collected from industrial sites. POTWs not accepting hauled or dedicated pipeline hazardous wastes but that are considering doing so, should be aware of the RCRA responsibilities and potential liabilities associated with such practices.

Summary

Domestic septage can be partially digested, higher in metals concentrations than normal domestic wastes, or contain small amounts of household contaminants (e.g., cleaners). Similarly, disinfectants used in portable toilets have the potential to impact POTW operations. Receipt of hauled hazardous waste (as defined in the Resource Conservation and Recovery Act (**RCRA**) may not only impact POTW operations, but subject the POTW to additional reporting requirements. The Domestic Sewage Exclusion, specified in 40 CFR §261.4 (a)(1)(ii), provides that hazardous wastes mixed with domestic sewage are exempt from the RCRA waste regulations.

However, hazardous wastes received by truck or rail (or dedicated pipe) are not exempt from the regulations. POTWs that accept hazardous wastes from these sources are granted "**permit by rule**" status under RCRA (40 CFR §270.60(c)) provided that certain requirements are met. The two most significant conditions are that the POTW must be in compliance with all of its NPDES permit requirements and the waste must comply with all Federal, State, and local pretreatment requirements. Nationwide, very few POTWs are knowingly accepting hauled hazardous waste.

POTWs should be aware that hauled process wastes from facilities subject to Federal categorical pretreatment standards are still subject to those standards. This condition highlights the need for POTWs to have a clear understanding of the source of the waste since applicable standards may be based on the origin of that waste.

Another potential problematic waste is that from remedial site clean-up operations. Groundwater contaminated with gasoline or diesel fuel is by far the most common type of waste from these operations. While these wastes may contain flammable and toxic compounds (e.g., benzene and toluene), another concern is that large volumes of this waste at a small POTW may actually "**flush**" the treatment plant, thereby interfering with treatment operations. Similar concerns also exist for landfill leachate, another commonly hauled wastestream. Remedial wastes may also come from Comprehensive Environmental Response, Compensation, and Liability Act (**CERCLA**) sites, also known as Superfund sites. For CERCLA guidance, refer to the EPA's 1990 *CERCLA Site Discharges to POTWs Guidance Manua*l.

Other concerns for POTWs that accept hauled wastes include:
Illegal dischargers may be discharging toxic pollutants that can pass through or interfere with the POTW operations;

- ✓ Grease trap wastes can coat and inhibit POTW treatment operations;
- ✓ Local limits may not account for pollutants in hauled wastes;
- ✓ Hauled wastes may contain pollutants for which local limits do not exist; thus, the impacts of this waste are not readily identifiable;
- ✓ Hauled wastes may be unmixed and/or highly concentrated.

For further information on the acceptance of hazardous waste at POTWs, refer to the *Guidance Manual for the Identification of Hazardous Wastes Delivered to Publicly Owned Treatment Works by Truck, Rail, or Dedicated Pip*e.

Topic 11- POTW Hauled and Hazardous Wastes Requirements Post Quiz

Domestic Septage

1. Disinfectants used in portable toilets have the potential to impact POTW operations. Receipt of __________________ (as defined in the Resource Conservation and Recovery Act (**RCRA**) may not only impact POTW operations, but subject the POTW to additional reporting requirements.

2. The Domestic Sewage Exclusion, specified in 40 CFR §261.4 (a)(1)(ii), provides that hazardous wastes mixed with ________________ are exempt from the RCRA waste regulations.

3. Nationwide, very few POTWs are knowingly accepting _______________.

4. POTWs should be aware that _____________ from facilities subject to Federal categorical pretreatment standards are still subject to those standards.

Other concerns for POTWs that accept hauled wastes include:

5. Local limits may not account for pollutants in ___________________.

6. Hauled wastes may be unmixed and/or highly concentrated.
True or False

Resource Conservation and Recovery Act Introduction

7. The Resource Conservation and Recovery Act (RCRA) authorizes EPA to control hazardous wastes, including the generation, transportation, treatment, storage, and disposal of hazardous waste. RCRA also provides EPA a framework for managing of __________________.

8. POTWs and industrial users that generate ______________ and POTWs accepting hazardous waste must comply with both CWA and RCRA requirements.

Biosolids – Sewage Sludge

9. Biosolids are treated sewage sludge and regulated by 40 CFR Part 503. The general pretreatment regulations, 40 CFR Part 403 establish standards and mechanisms for responsible entities to control _______________that might pass through or interfere with publicly owned treatment works (POTW) treatment processes or contaminate sewage sludge.

Hauled Waste Requirements

10. The term "hauled waste" refers to the wastes' transportation method to the POTW. Hauled waste might be ______________, or it might include non-domestic waste, or a combination of both types of waste.

11. Wastes are hauled to POTWs for several reasons. By far, the majority of hauled waste is________________.

POTW waste hauler control programs should address the following six elements:

12. POTWs may require haulers or generators of hauled waste to perform a treatability study to demonstrate the________________________.

13. POTWs must evaluate the impacts of this waste when evaluating the _____________ as well as when developing or revising local limits.

14. Unique permit conditions may include: right of refusal, ____________________, discharge time limitations, and manifesting requirements.

15. Discharge Point - As specified in the General Pretreatment Regulations, ______________ can only be discharged at points designated by the POTW.

16. Monitoring - The POTW should institute a monitoring program to evaluate the nature and ____________________.

17. Both POTW monitoring and hauler self-monitoring may be appropriate. Many POTWs require that ____________________ must be sampled, but analyses are only performed on a predetermined percentage of these wastes or when problems occur.

18. Unanalyzed samples are refrigerated and kept for several weeks or months until the POTW is certain that the _________________________________.

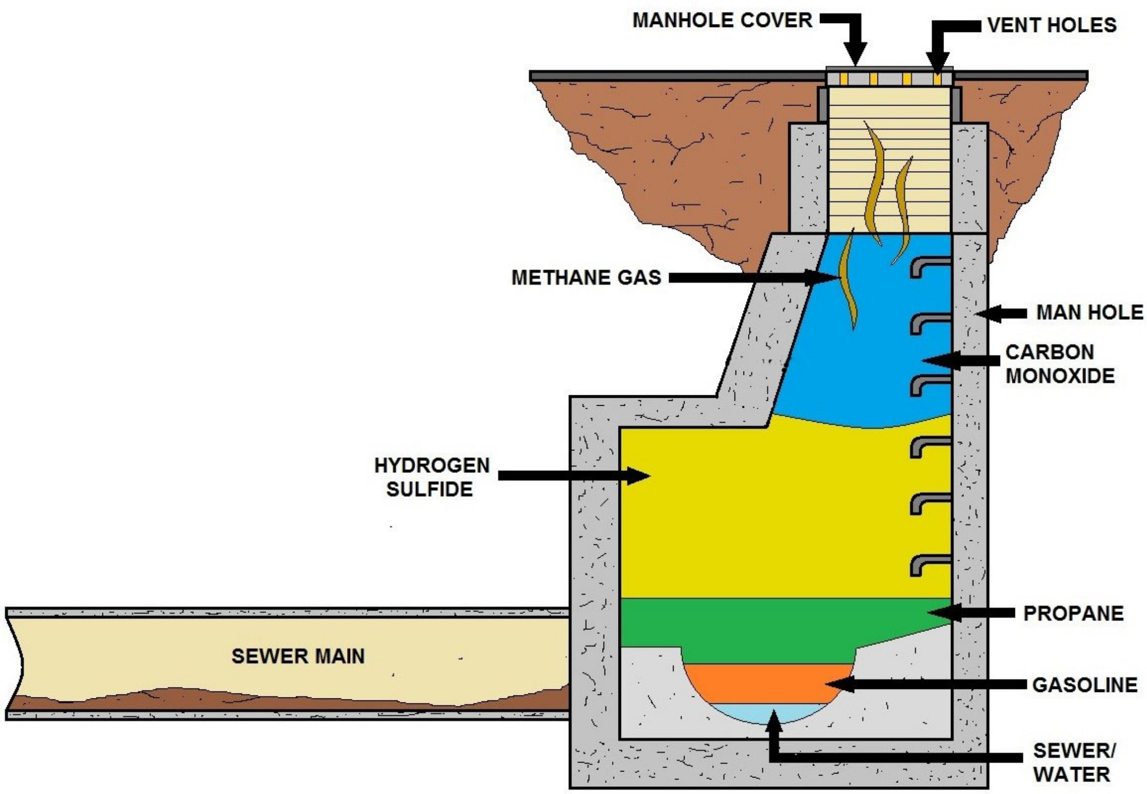
19. Which of the following terms may also be dependent on the variability of the waste? Each load from a hauler that delivers highly variable loads may have to be sampled and analyzed; whereas, a much smaller percentage may be appropriate for more consistent waste types.

20. Hauler Documentation - The POTW should require waste haulers to document the source of wastes being discharged, potentially including _________________.

Topic 12 – Confined Space Section

Topic 12 - Section Focus: You will learn the basics of entering a confined space and understand the dangers of working in a permit required confined space. At the end of this section, you will be able to understand and describe flammable atmospheres. Differentiate between toxic, irritant, and asphyxiating atmospheres. Describe preventive measures in terms of hazards. There is a post quiz at the end of this section to review your comprehension and a final examination in the Assignment for your contact hours.

Topic 12 – Scope/Background: Many pretreatment/POTW related workplaces (manholes, vaults, flumes) contain spaces that are considered "confined" because their configurations hinder the activities of any employees who must enter, work in, and exit them. For example, employees who work in vaults for sampling generally must squeeze in and out through narrow openings and perform their tasks while cramped or contorted. OSHA uses the term "confined space" to describe such spaces.



POSSIBLE HAZARDOUS ATMOSPHERES PRESENT IN A CONFINED SPACE (EXAMPLE IS OF A SEWER MAIN)

Confined space dangers is one of the largest safety hazards facing pretreatment inspectors. Many operators and inspectors develop all types of lung diseases years after entering confined spaces.

Is Entry Necessary?

Can the task be accomplished from the outside? For example, measures that eliminate the need for employees to enter confined spaces should be carefully evaluated and implemented if at all possible before considering human entry into confined spaces to perform non-emergency tasks.

Confined Spaces are

-large enough to allow entry of any body part, and
-limited or restricted entry or exit, and
-not designed for continuous employee occupancy

Permit Required Confined Spaces are confined spaces that have any of the following
-potential hazardous atmosphere
-material inside that may engulf or trap you
-internal design that could trap or asphyxiate you
-any other serious safety or health hazard

Entry Permits are required before you enter any
"**Permit Required Confined Space**"

Hazards include

- Fire & Explosion
- Engulfment
- Asphyxiation
- Entrapment
- Slips & Falls
- Electric Shock
- Noise & Vibration
- Chemical Exposure
- Toxic Atmospheres
- Thermal / Chemical Burns

Engineering Controls

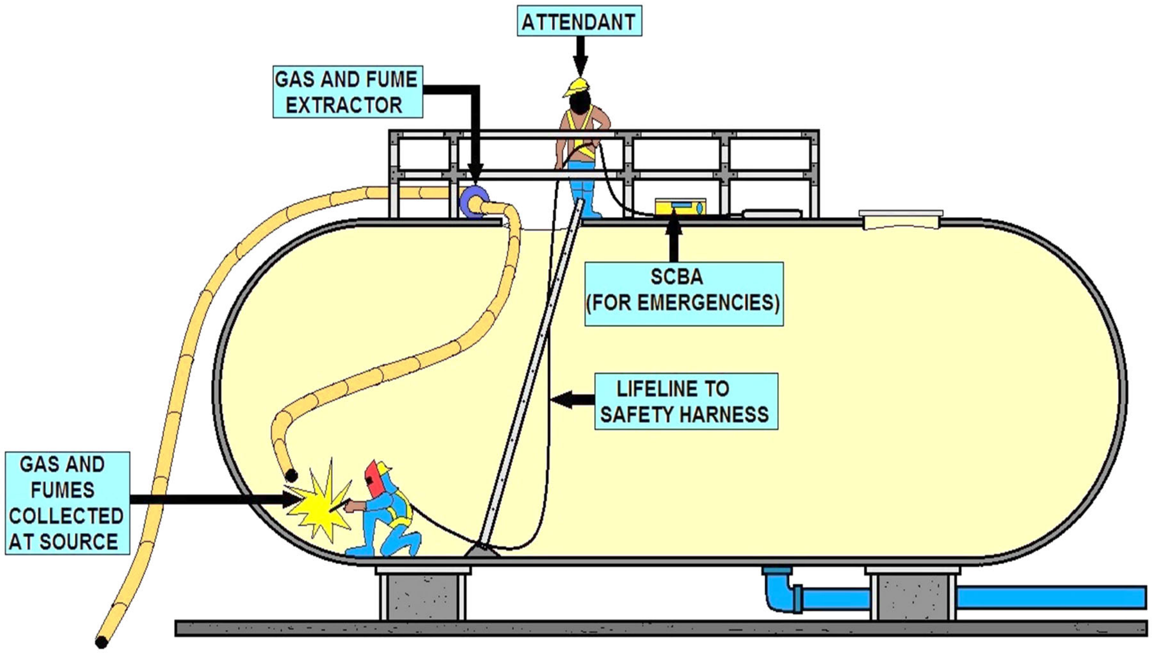
- ❑ Ventilation
- ❑ Locked Access
- ❑ Lighting

Administrative Controls

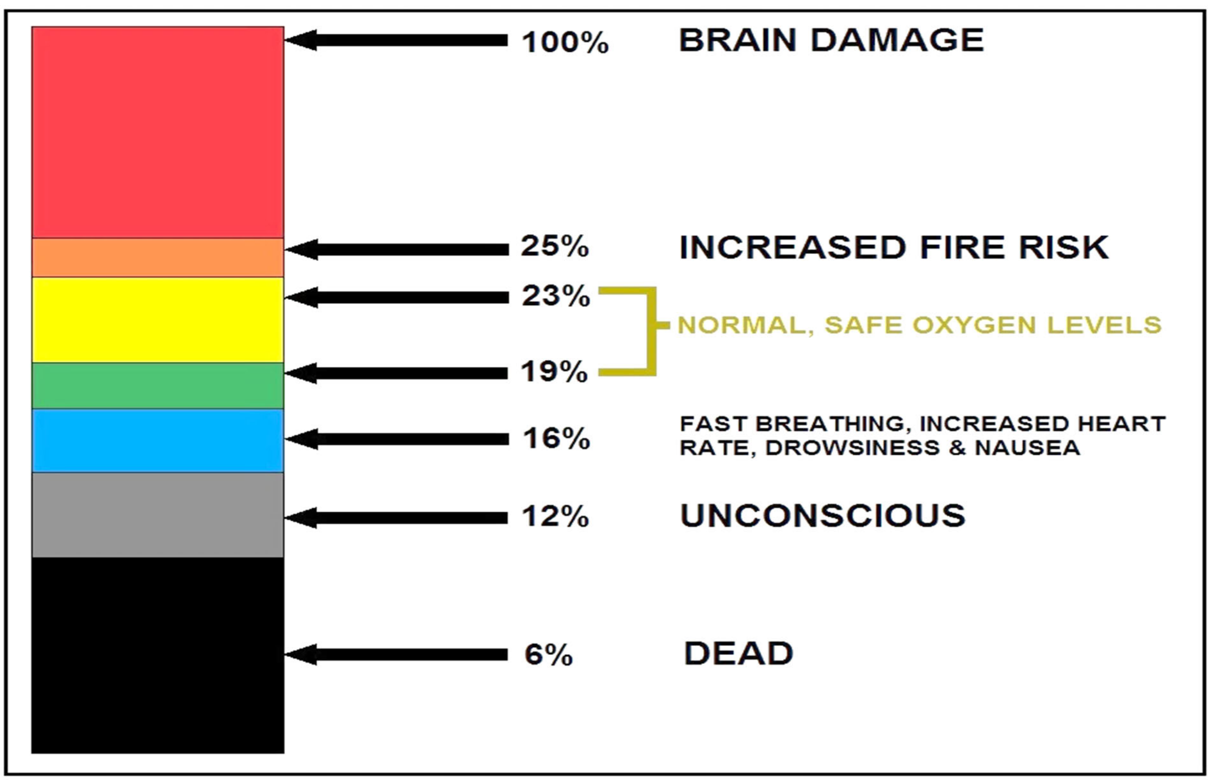
- ❑ Controlled Access
- ❑ Hazard Assessments
- ❑ Entry Permits & Procedures
- ❑ Signs & Lockout Tagout
- ❑ Training

Smart Safety Rules

Know what you are getting into.
Know how to get out in an emergency.
Know the hazards & how they are controlled.
Only authorized & trained personnel may enter a Confined Space or act as an attendant.
No smoking in Confined Space or near entrance or exit area.
Attendant must be present at all times.
Constant visual or voice communication must be maintained between the attendant and entrants.
No bottom or side entry will be made, or work conducted below the level any hanging material or material which could cause engulfment.
Air and oxygen monitoring is required before entering a Permit-Required Confined Space.
Ventilation & oxygen monitoring is required when welding is performed.



CONFINED SPACE DIAGRAM



RESULTS OF OXYGEN LEVELS IN CONFINED SPACES

A Confined Space Entry Program

Should Include the Following:

- Written confined space entry procedures
- Evaluation to determine whether entry is necessary
- Issuance of a confined space entry permit
- Evaluation of the confined space by a qualified person
- Testing and monitoring the air quality in the confined space to ensure:
- Oxygen level is at least 19.5%
- Flammable range is less than 10% of the LFL (lower flammable limit)
- Training of workers and supervisors in the selection and use of:
    - *safe entry procedures*
    - *respiratory protection*
    - *lifelines and retrieval systems*
    - *protective clothing*
- Training of employees in safe work procedures in and around confined spaces
- Training of employees in confined space rescue procedures
- Conducting safety meetings to discuss confined space safety
- Availability and use of proper ventilation equipment
- Monitoring the air quality while workers are in the confined space.

Recommendation #2: Employers should identify the types of confined spaces within their jurisdiction and develop and implement confined space entry and rescue programs.

Discussion: Employers may be required to enter confined spaces to perform either non-emergency tasks or emergency rescue.

Therefore, employers should identify the types of confined spaces within their jurisdiction and develop and implement confined space entry and rescue programs that include written emergency rescue guidelines and procedures for entering confined spaces. A confined space program, as outlined in NIOSH Publications 80-106 and 87-113, should be implemented. At a minimum, the following should be addressed:

1. Is entry necessary? Can the task be accomplished from the outside? For example, measures that eliminate the need for employees to enter confined spaces should be carefully evaluated and implemented if at all possible before considering human entry into confined spaces to perform non-emergency tasks.

2. If entry is to be made, has the air quality in the confined space been tested for safety based on the following:

- oxygen supply at least 19.5%
- flammable range for all explosive gases less than 10% of the lower flammable limit
- absence of toxic air contaminants?

3. Is ventilation equipment available and/or used?

4. Is appropriate rescue equipment available?

5. Are supervisors being continuously trained in the selection and use of appropriate rescue equipment such as:

- **SCBA's**
- **lifelines**
- **human hoist systems offering mechanical advantage**
- **protective clothing**
- **ventilation systems**

6. Are employees being properly trained in confined space entry procedures?

7. Are confined space safe work practices discussed in safety meetings?

8. Are employees trained in confined space rescue procedures?

9. Is the air quality monitored when the ventilation equipment is operating?

The American National Standards Institute (ANSI) Standard Z117.1-1989 (Safety Requirements for Confined Spaces), 3.2 and 3.2.1 state, "***Hazards shall be identified for each confined space. The hazard identification process shall include, ... the past and current uses of the confined space which may adversely affect the atmosphere of the confined space; ... The hazard identification process should consider items such as ... the operation of gasoline engine powered equipment in or around the confined space***."

CONFINED SPACE ENTRY CHECKLIST EXAMPLE

Confined Space Terms

"Acceptable entry conditions" means the conditions that must exist in a permit space to allow entry and to ensure that employees involved with a permit-required confined space entry can safely enter into and work within the space.

"Attendant" means an individual stationed outside one or more permit spaces who monitors the authorized entrants and who performs all attendant's duties assigned in the employer's permit space program.

"Authorized entrant" means an employee who is authorized by the employer to enter a permit space.

"Blanking or blinding" means the absolute closure of a pipe, line, or duct by the fastening of a solid plate (such as a spectacle blind or a skillet blind) that completely covers the bore and that is capable of withstanding the maximum pressure of the pipe, line, or duct with no leakage beyond the plate.

"Confined space" means a space that:
(1) Is large enough and so configured that an employee can bodily enter and perform assigned work; and

(2) Has limited or restricted means for entry or exit (for example, tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry.); and

(3) Is not designed for continuous employee occupancy.

"Double block and bleed" means the closure of a line, duct, or pipe by closing and locking or tagging two in-line valves and by opening and locking or tagging a drain or vent valve in the line between the two closed valves.

"Emergency" means any occurrence (including any failure of hazard control or monitoring equipment) or event internal or external to the permit space that could endanger entrants.

"Engulfment" means the surrounding and effective capture of a person by a liquid or finely divided (flowable) solid substance that can be aspirated to cause death by filling or plugging the respiratory system or that can exert enough force on the body to cause death by strangulation, constriction, or crushing.

"Entry" means the action by which a person passes through an opening into a permit-required confined space. Entry includes ensuing work activities in that space and is considered to have occurred as soon as any part of the entrant's body breaks the plane of an opening into the space.

"Entry permit (permit)" means the written or printed document that is provided by the employer to allow and control entry into a permit space and that contains the information specified in paragraph (f) of this section.

"Entry supervisor" means the person (such as the employer, foreman, or crew chief) responsible for determining if acceptable entry conditions are present at a permit space where entry is planned, for authorizing entry and overseeing entry operations, and for terminating entry as required by this section.

NOTE: An entry supervisor also may serve as an attendant or as an authorized entrant, as long as that person is trained and equipped as required by this section for each role he or she fills. Also, the duties of entry supervisor may be passed from one individual to another during the course of an entry operation.

"Hazardous atmosphere" means an atmosphere that may expose employees to the risk of death, incapacitation, impairment of ability to self-rescue (that is, escape unaided from a permit space), injury, or acute illness from one or more of the following causes:

(1) Flammable gas, vapor, or mist in excess of 10 percent of its lower flammable limit (LFL);

(2) Airborne combustible dust at a concentration that meets or exceeds its LFL;

NOTE: This concentration may be approximated as a condition in which the dust obscures vision at a distance of 5 feet (1.52 m) or less.

(3) Atmospheric oxygen concentration below 19.5 percent or above 23.5 percent;

(4) Atmospheric concentration of any substance for which a dose or a permissible exposure limit is published in Subpart G, Occupational Health and Environmental Control, or in Subpart Z, Toxic and Hazardous Substances, of this Part and which could result in employee exposure in excess of its dose or permissible exposure limit;

NOTE: An atmospheric concentration of any substance that is not capable of causing death, incapacitation, impairment of ability to self-rescue, injury, or acute illness due to its health effects is not covered by this provision.

(5) Any other atmospheric condition that is immediately dangerous to life or health.
NOTE: For air contaminants for which OSHA has not determined a dose or permissible exposure limit, other sources of information, such as Material Safety Data Sheets that comply with the Hazard Communication Standard, section 1910.1200 of this Part, published information, and internal documents can provide guidance in establishing acceptable atmospheric conditions.

"Hot work permit" means the employer's written authorization to perform operations (for example, riveting, welding, cutting, burning, and heating) capable of providing a source of ignition.

"Immediately dangerous to life or health (IDLH)" means any condition that poses an immediate or delayed threat to life or that would cause irreversible adverse health effects or that would interfere with an individual's ability to escape unaided from a permit space.

NOTE: Some materials -- hydrogen fluoride gas and cadmium vapor, for example -- may produce immediate transient effects that, even if severe, may pass without medical attention, but are followed by sudden, possibly fatal collapse 12-72 hours after exposure. The victim "feels normal" from recovery from transient effects until collapse. Such materials in hazardous quantities are considered to be "immediately" dangerous to life or health.

"Inerting" means the displacement of the atmosphere in a permit space by a noncombustible gas (such as nitrogen) to such an extent that the resulting atmosphere is noncombustible.

NOTE: This procedure produces an IDLH oxygen-deficient atmosphere.

"Isolation" means the process by which a permit space is removed from service and completely protected against the release of energy and material into the space by such means as: blanking or blinding; misaligning or removing sections of lines, pipes, or ducts; a double block and bleed system; lockout or tagout of all sources of energy; or blocking or disconnecting all mechanical linkages.

"Line breaking" means the intentional opening of a pipe, line, or duct that is or has been carrying flammable, corrosive, or toxic material, an inert gas, or any fluid at a volume, pressure, or temperature capable of causing injury.

"Non-permit confined space" means a confined space that does not contain or, with respect to atmospheric hazards, have the potential to contain any hazard capable of causing death or serious physical harm.

"Oxygen deficient atmosphere" means an atmosphere containing less than 19.5 percent oxygen by volume.

"Oxygen enriched atmosphere" means an atmosphere containing more than 23.5 percent oxygen by volume.

"Permit-required confined space (permit space)" means a confined space that has one or more of the following characteristics:

(1) Contains or has a potential to contain a hazardous atmosphere;

(2) Contains a material that has the potential for engulfing an entrant;

(3) Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section; or

(4) Contains any other recognized serious safety or health hazard.

"Permit-required confined space program (permit space program)" means the employer's overall program for controlling, and, where appropriate, for protecting employees from, permit space hazards and for regulating employee entry into permit spaces.

"Permit system" means the employer's written procedure for preparing and issuing permits for entry and for returning the permit space to service following termination of entry.

"Prohibited condition" means any condition in a permit space that is not allowed by the permit during the period when entry is authorized.

"Rescue service" means the personnel designated to rescue employees from permit spaces.

"Retrieval system" means the equipment (including a retrieval line, chest or full-body harness, wristlets, if appropriate, and a lifting device or anchor) used for non-entry rescue of persons from permit spaces.

"Testing" means the process by which the hazards that may confront entrants of a permit space are identified and evaluated. Testing includes specifying the tests that are to be performed in the permit space.

D-Ring on the rear of the harness is necessary for the entrant to be retrieved from the confined space.

Confined Space Entry Program

Purpose
The Confined Space Entry Program is provided to protect authorized employees that will enter confined spaces and may be exposed to hazardous atmospheres, engulfment in materials, conditions which may trap or asphyxiate due to converging or sloping walls, or contains any other safety or health hazards.
Reference: OSHA-Permit-Required Confined Spaces (**29 CFR 1910.146**).

Scope
You are required to recognize the dangers and hazards associated with confined spaces, and this program is designed to assist you in the safety of and compliance with the OSHA standards associated with such.

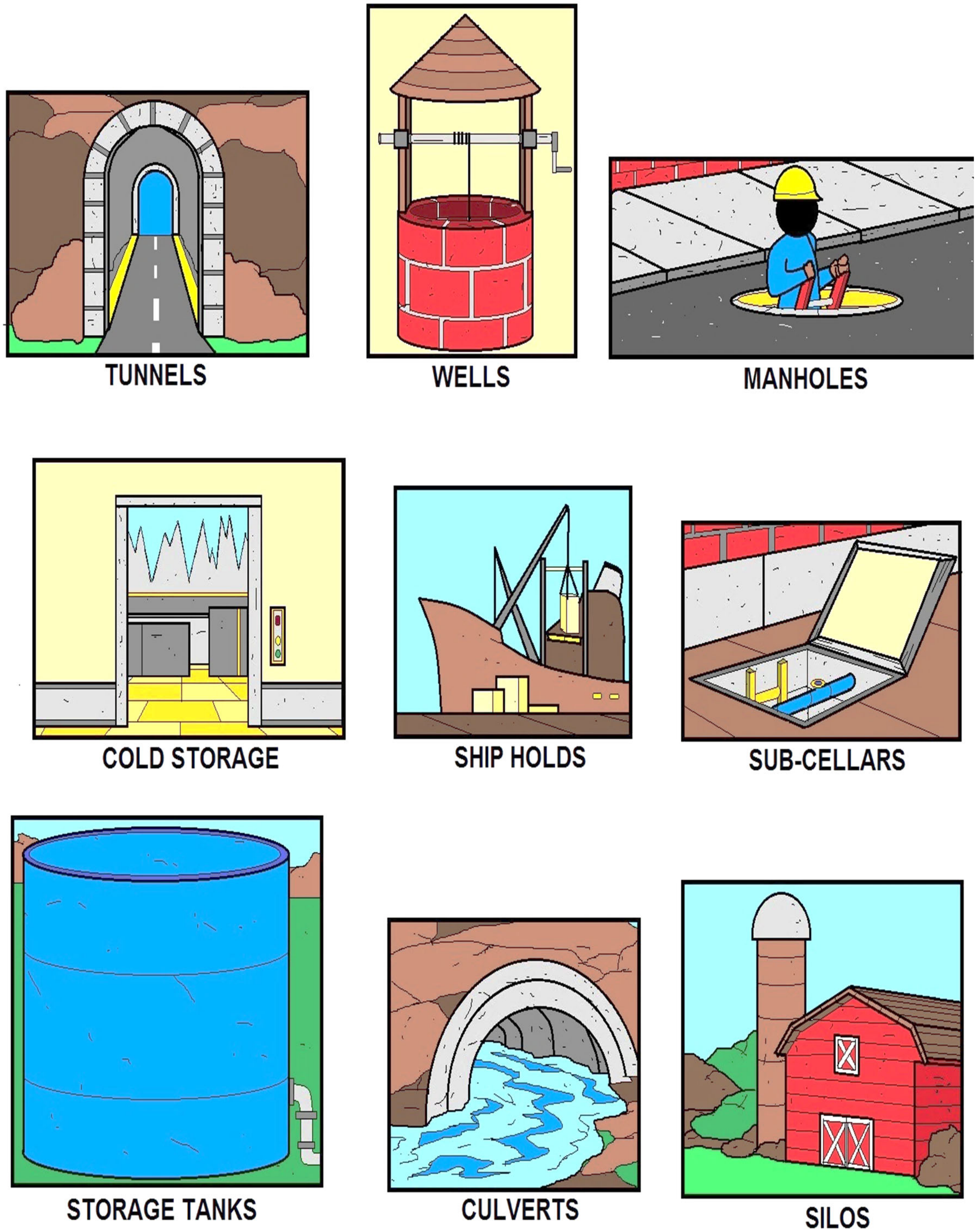
Most communities will utilize the Fire Department for all rescues and additional assistance dealing with confined spaces, understanding that most Fire Department operations utilize additional in house SOG's/SOP's pertaining to such operations.

Definitions
Confined space:

- ✓ Is large enough or so configured that an employee can bodily enter and perform work.
- ✓ Has limited or restricted means for entry or exit (i.e. tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry).
- ✓ Is not designed for continuous employee occupancy.
- ✓ Permit required confined space (permit space), is a confined space that has one or more of the following characteristics:

1. Contains or has a potential to contain a hazardous atmosphere.
2. Contains a material that has the potential for engulfing an entrant.
3. Has an internal configuration such that an entrant could be trapped or asphyxiated by inwardly covering walls or by a floor which slopes downward and tapers to a smaller cross-section.
4. Contains any other recognized serious safety or health hazard.

Each Permit-Required Confined Space will be marked "*Confined Space - Entry Permit Required*".
Most of this text is credited to OSHA.



EXAMPLES OF CONFINED SPACES

Confined Space Hazards

Fatalities and injuries constantly occur among construction workers who, during the course of their jobs, are required to enter confined spaces. In some circumstances, these workers are exposed to multiple hazards, any of which may cause bodily injury, illness, or death.

Newspaper and magazine articles abound with stories of workers injured and killed from a variety of atmospheric factors and physical agents. Throughout the construction jobsite, contractors and workers encounter both inherent and induced hazards within confined workspaces.

Inherent Hazards
Inherent hazards, such as electrical, thermal, chemical, mechanical, etc., are associated with specific types of equipment and the interactions among them.

Examples include high voltage (shock or corona discharge and the resulting burns), radiation generated by equipment, defective design, omission of protective features (no provision for grounding non-current-carrying conductive parts), high or low temperatures, high noise levels, and high-pressure vessels and lines (rupturing with resultant release of fragments, fluids, gases, etc.).

Inherent hazards usually cannot be eliminated without degrading the system or equipment, or without making them inoperative. Therefore, emphasis must be placed on hazard control methods.

Induced Hazards
Induced hazards arise, and are induced from, a multitude of incorrect decisions and actions that occur during the actual construction process. Some examples are: omission of protective features, physical arrangements that may cause unintentional worker contact with electrical energy sources, oxygen-deficient atmospheres created at the bottom of pits or shafts, lack of safety factors in structural strength, and flammable atmospheres.

Typical Examples of Confined Workspaces
Following are typical examples of confined workspaces in construction which contain both inherent and induced hazards.

Vaults
A variety of vaults are found on the pretreatment jobsite. On various occasions, workers must enter these vaults to perform a number of functions.

The restricted nature of vaults and their frequently below-grade location can create an assortment of safety and health problems.

Oxygen-Deficient Atmosphere
One of the major problems confronting pretreatment workers while working in vaults is the ever-present possibility of an oxygen-deficient atmosphere.

Explosive or Toxic Gases, Vapors, or Fumes
While working in a vault, workers may be exposed to the build-up of explosive gases such as those used for heating (propane).

Electrical Shock
Electrical shock is often encountered from power tools, line cords, etc. In many instances, such electrical shock results from the fact that the contractor has not provided an approved grounding system or the protection afforded by ground-fault circuit interrupters or low-voltage systems.

Purging
In some instances, purging agents such as nitrogen and argon may enter the vault from areas adjacent to it. These agents may displace the oxygen in the vault to the extent that it will asphyxiate workers almost immediately.

Materials Falling In and On
A hazard normally considered a problem associated with confined spaces is material or equipment which may fall into the vault or onto operators as they enter and leave the vault.

Vibration could cause the materials on top of the vault to roll off and strike workers. If the manhole covers were removed, or if they were not installed in the first place, materials could fall into the vault, causing injury to the workers inside.

Condenser Pits
A common confined space found in the construction of nuclear power plants is the condenser pit. Because of their large size, they are often overlooked as potentially hazardous confined spaces.

These below-grade areas create large containment areas for the accumulation of toxic fumes, gases, and so forth, or for the creation of oxygen-deficient atmospheres when purging with argon, Freon, and other inert gases.

Other hazards will be created by workers above dropping equipment, tools, and materials into the pit.

Manholes
Throughout the construction site, manholes are commonplace. As means of entry into and exit from vaults, tanks, pits, and so forth, manholes perform a necessary function. However, these confined spaces may present serious hazards which could cause injuries and fatalities.

A variety of hazards are associated with manholes. To begin with, the manhole could be a dangerous trap into which the worker could fall. Often covers are removed and not replaced, or else they are not provided in the first place.

Pipe Assemblies
One of the most frequently unrecognized types of confined spaces encountered throughout the construction site is the pipe assembly. Piping of sixteen to thirty-six inches in diameter is commonly used for a variety of purposes. For any number of reasons, operators will enter the pipe. Once inside, they are faced with potential oxygen-deficient atmospheres, often caused by purging with argon or another inert gas. Welding fumes generated by the worker in the pipe, or by other workers operating outside the pipe at either end, subject the worker to toxic atmospheres.

The generally restricted dimensions of the pipe provide little room for the workers to move about and gain any degree of comfort while performing their tasks. Once inside the pipe, communication is extremely difficult. In situations where the pipe bends, communication and extrication become even more difficult. Electrical shock is another problem to which the worker is exposed.

Ungrounded tools and equipment or inadequate line cords are some of the causes. As well, heat within the pipe run may cause the worker to suffer heat prostration.

Ventilation Ducts
Ventilation ducts, like pipe runs, are very common at the wastewater treatment facility. These sheet metal enclosures create a complex network which moves heated and cooled air and exhaust fumes to desired locations in the plant.

Ventilation ducts may require that workers enter them to cut out access holes, install essential parts of the duct, etc. Depending on where these ducts are located, oxygen deficiency could exist. They usually possess many bends, which create difficult entry and exit and which also make it difficult for workers inside the duct to communicate with those outside it. Electrical shock hazards and heat stress are other problems associated with work inside ventilation ducts.

Tanks
Tanks are another type of confined workspace commonly found at treatment plants and pretreatment facilities. They are used for a variety of purposes, including the storage of water, chemicals, etc.

Tanks require entry for cleaning and repairs. Ventilation is always a problem. Oxygen-deficient atmospheres, along with toxic and explosive atmospheres created by the substances stored in the tanks, present hazards to workers. Heat, another problem in tanks, may cause heat prostration, particularly on a hot day.

Sumps
Sumps are commonplace. They are used as collection places for water and other liquids. Operators or Inspectors entering sumps may encounter an oxygen-deficient atmosphere.

Also, because of the wet nature of the sump, electrical shock hazards are present when power tools are used inside. Sumps are often poorly illuminated. Inadequate lighting may create an accident situation.

Containment Cavities
These large below-grade areas are characterized by little or no air movement. Ventilation is always a problem. In addition, the possibility of oxygen deficiency exists. As well, welding and other gases may easily collect in these areas, creating toxic atmospheres. As these structures near completion, more confined spaces will exist as rooms are built off the existing structure.

Electrical Transformers
Electrical transformers often contain a nitrogen purge or dry air. Before they are opened, they must be well vented by having air pumped in. Workers, particularly electricians and power plant operators, will enter these transformers through hatches on top for various work-related reasons. Testing for oxygen deficiency and for toxic atmospheres is mandatory.

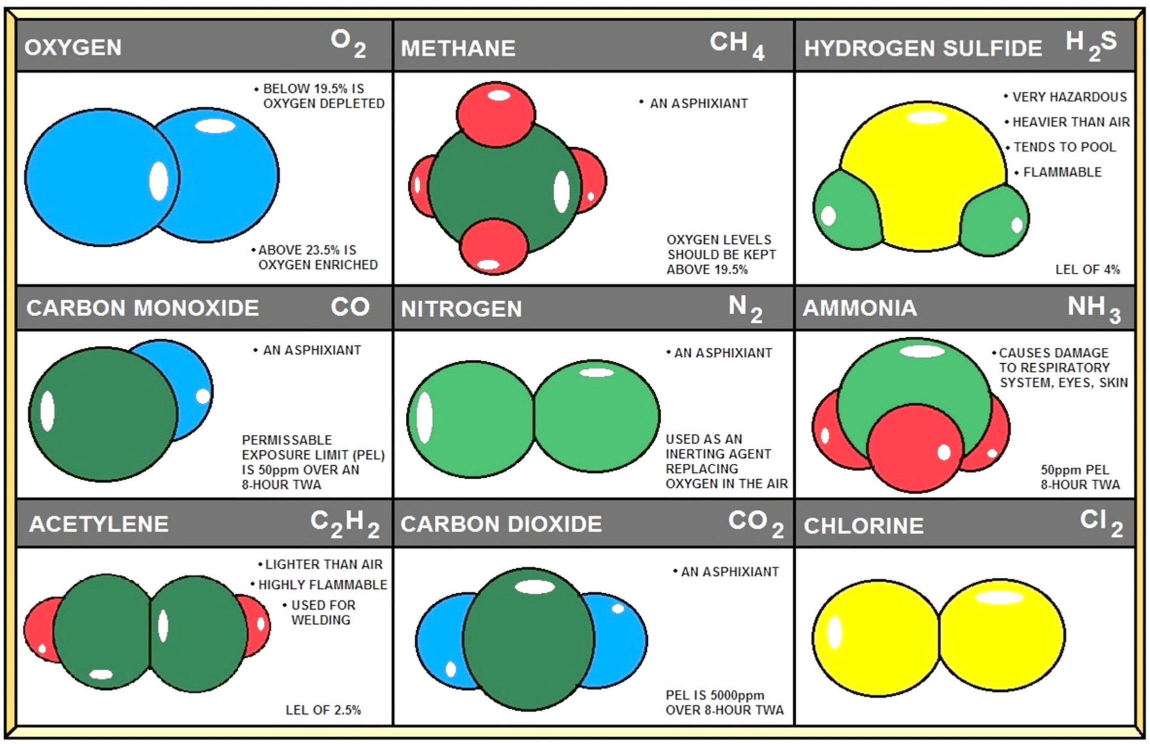
Heat Sinks
These larger pit areas hold cooling water in the event that there is a problem with the pumps located at the water supply to the plant--normally a river or lake--which would prevent cooling water from reaching the reactor core.

When in the pits, workers are exposed to welding fumes and electrical hazards, particularly because water accumulates in the bottom of the sink.

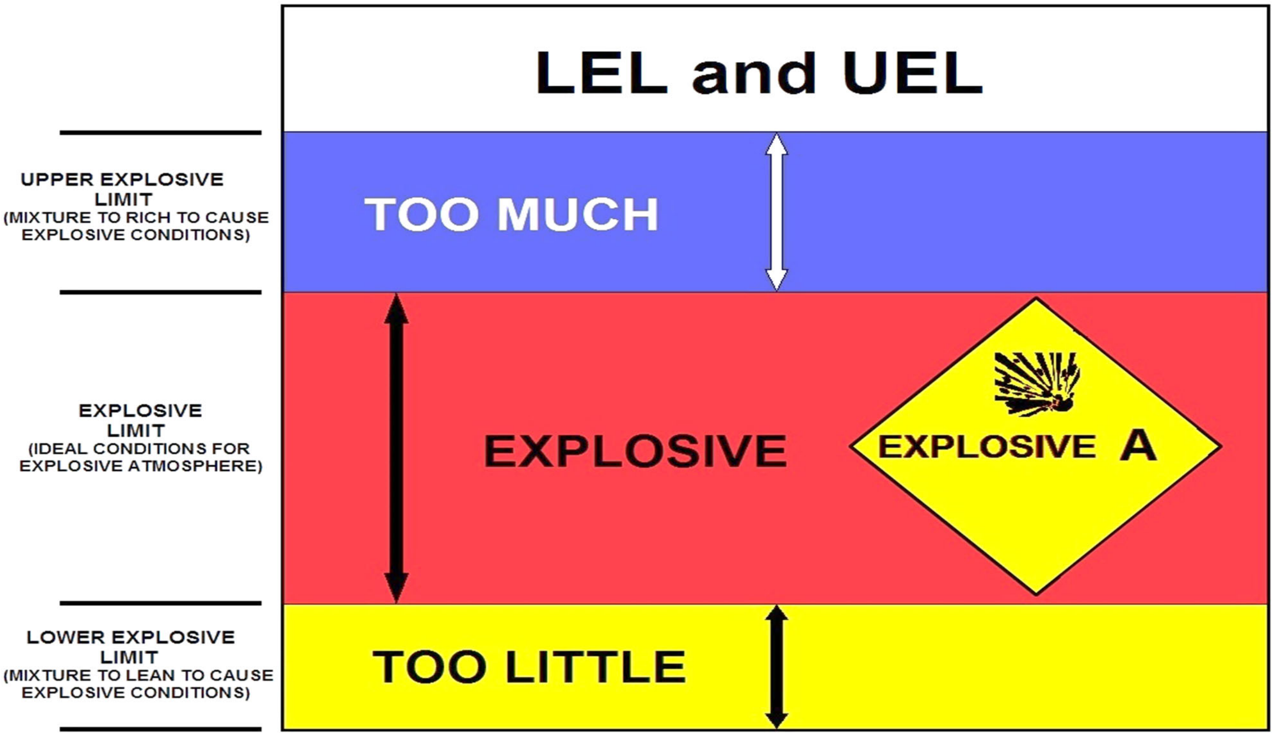
Generally, it is difficult to communicate with inspectors or operators in the heat sink, because the rebar in the walls of the structure deaden radio signals.

COMMON HAZARDOUS GASES THAT MAY BE PRESENT IN CONFINED SPACE					
SUBSTANCE *	8-HOUR TIME-WEIGHTED AVERAGE (TWA)	15-MINUTE SHORT-TERM EXPOSURE LIMIT (STEL)	CEILING LIMIT (Never To Be Exceeded)	IMMEDIATELY DANGEROUS TO LIFE AND HEALTH (IDLH)	RECOMMENDED ALARM SETTINGS (Low / High)
AMMONIA	25 ppm	35 ppm	—	300 ppm	13 ppm / 25 ppm
CARBON MONOXIDE	25 ppm	100 ppm	—	1200 ppm	13 ppm / 25 ppm
CHLORINE	0.5 ppm	1 ppm	—	10 ppm	0.25 ppm / 0.5 ppm
HYDROGEN SULFIDE	—	—	10 ppm	100 ppm	5 ppm / 10 ppm
METHANE	1000 ppm	—	—	—	500 ppm / 1000 ppm
NITROGEN DIOXIDE	—	—	1 ppm	20 ppm	0.5 ppm / 1 ppm
SULFUR DIOXIDE	2 ppm	5 ppm	—	100 ppm	1 ppm / 2 ppm
OXYGEN	—	—	—	—	20.5 % of Atmosphere
LOWER EXPLOSIVE LIMIT (LEL)	—	—	—	—	5 % LEL

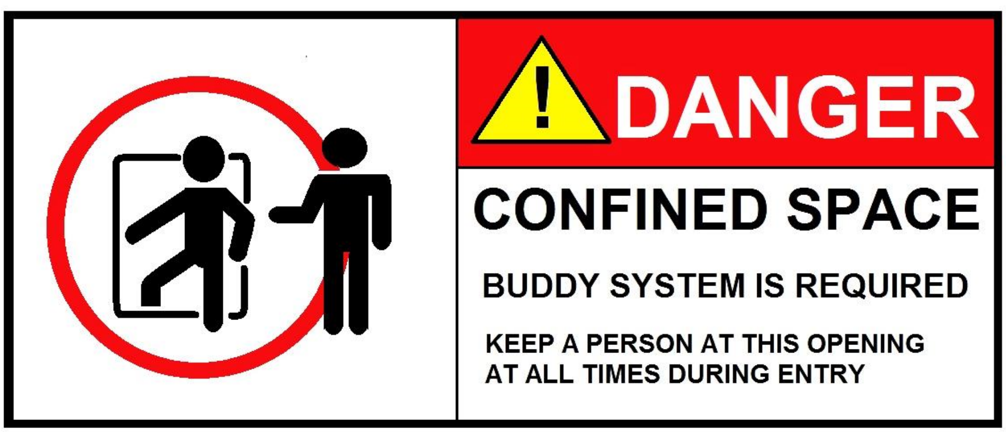
EXAMPLE OF A CHART OF CONFINED SPACE GASES



COMMON GASES THAT CAN BE FOUND IN CONFINED SPACE



UNDERSTANDING UPPER (UEL) & LOWER (LEL) EXPLOSIVE LIMITS



EXAMPLE OF A CONFINED SPACE ENTRY DANGER SIGN

Unusual Conditions

Confined Space within a Confined Space
By the very nature of sewer related work, situations are created which illustrate one of the most hazardous confined spaces of all--a confined space within a confined space.

This situation appears at treatment plants or IU facilities as tanks within pits, pipe assemblies or vessels within pits, etc. In this situation, not only do the potential hazards associated with the outer confined space require testing, monitoring, and control, but those of the inner space also require similar procedures.

Often, only the outer space is evaluated. When inspectors or operators enter the inner space, they are faced with potentially hazardous conditions.

A good example of a confined space within a confined space is a vessel with a nitrogen purge inside a filtering water access pit. Workers entering the pit and/or the vessel should do so only after both spaces have been evaluated and proper control measures established.

Hazards in One Space Entering another Space
During an examination of confined spaces in construction, one often encounters situations which are not always easy to evaluate or control. For instance, a room or area which classifies as a confined space may be relatively safe for work.

However, access passages from other areas outside or adjacent to the room could, at some point, allow the transfer of hazardous agents into the "***safe***" one. One such instance would be a pipe coming through a wall into a containment room.

At IU facilities, welding fumes and other toxic materials generated in one room may easily travel through the pipe into another area, causing it to change from a safe to an unsafe workplace.

A serious problem with a situation such as this is that workers working in the "**safe**" area are not aware of the hazards leaking into their area. Thus, they are not prepared to take action to avoid or control it.

Most of this text is credited to OSHA.

Permit Required Confined Space Entry Program

As a former pretreatment inspector, we never abided by these important safety rules and over time, everyone who worked with us was injured or came down with a lung disease.

Definition of Confined Spaces Requiring an Entry Permit
Confined space:

- ✓ Is large enough or so configured that an employee can bodily enter and perform work.
- ✓ Has limited or restricted means for entry or exit (i.e. tanks, vessels, silos, storage bins, hoppers, vaults, and pits are spaces that may have limited means of entry).
- ✓ Is not designed for continuous employee occupancy.

Purpose
The Permit Required Space (**PRCS**) Program is provided to protect authorized employees that will enter confined spaces and may be exposed to hazardous atmospheres, engulfment in materials, conditions which may trap or asphyxiate due to converging or sloping walls, or contains any other safety or health hazards.

Many workplaces contain confined spaces not designed for human occupancy which due to their configuration hinder employee activities including entry, work and exit. Asphyxiation is the leading cause of death in confined spaces.

Subpart P applies to all open excavations in the earth's surface.

- ✓ All trenches are excavations.
- ✓ All excavations are not trenches.

Permit Required Confined Space Entry General Rules

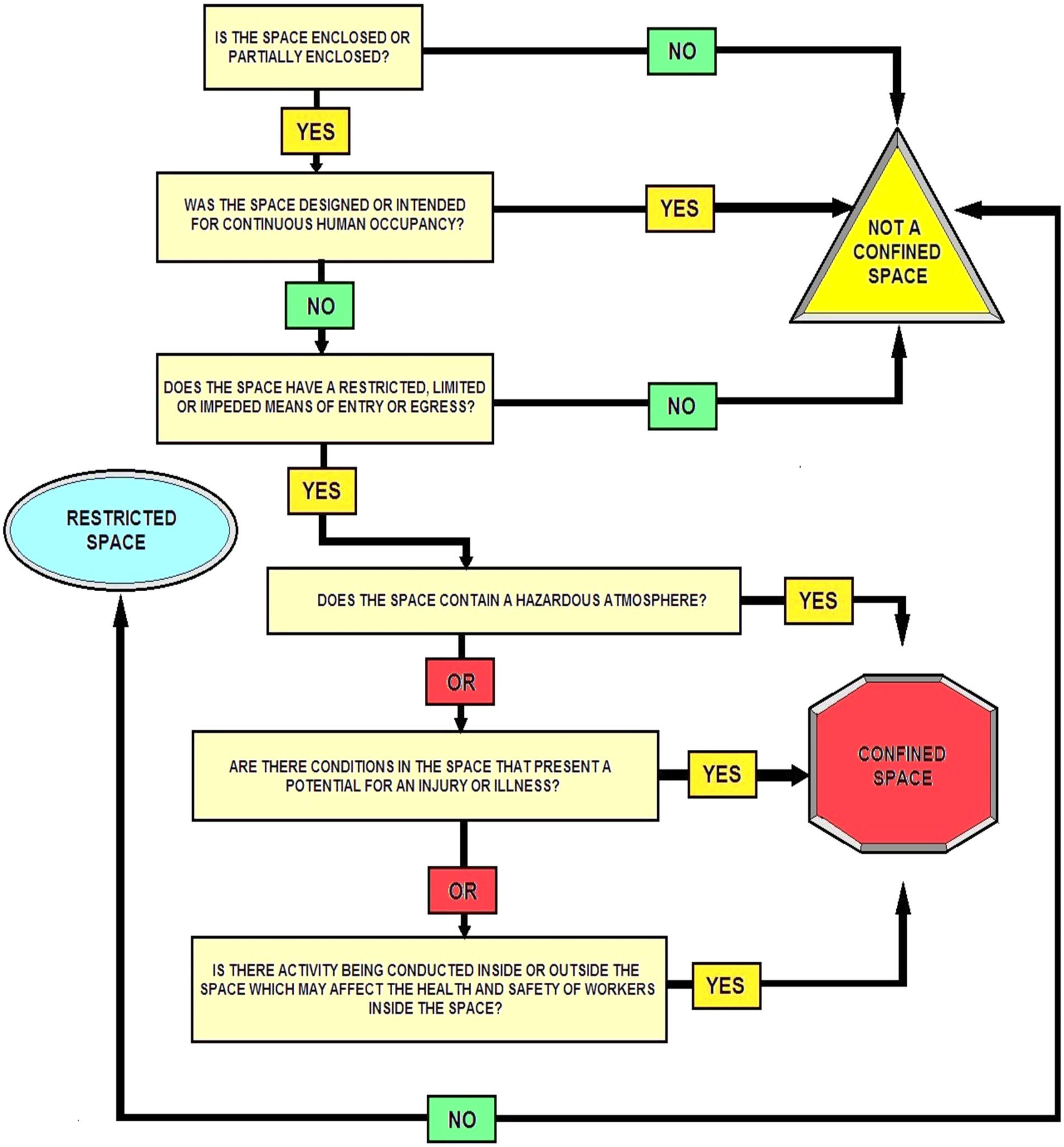
During all confined space entries, the following safety rules must be strictly enforced:

1. Only authorized and trained employees may enter a confined space or act as safety watchmen/attendants.
2. No smoking is permitted in a confined space or near entrance/exit area.
3. During confined space entries, a watchmen or attendant must be present at all times.
4. Constant visual or voice communication will be maintained between the safety watchmen and employees entering a confined space.
5. No bottom or side entry will be made or work conducted below the level any hanging material or material which could cause engulfment.
6. Air and oxygen monitoring is required before entering any permit-required confined space. Oxygen levels in a confined space must be between 19.5 and 23.5 percent. Levels above or below will require the use of an SCBA or other approved air supplied respirator. Additional ventilation and oxygen level monitoring is required when welding is performed. The monitoring will check oxygen levels, explosive gas levels and carbon monoxide levels. Entry will not be permitted if explosive gas is detected above one-half the Lower Explosive Limit (**LEL**).
7. To prevent injuries to others, all openings to confined spaces will be protected by a barricade when covers are removed.

Appendix A to §1910.146

Permit-Required Confined Space Decision Flow Chart

Note: Appendices A through F serve to provide information and non-mandatory guidelines to assist employers and employees in complying with the appropriate requirements of this section.



HOW TO DETERMINE CONFINED SPACES

Confined Space Entry Permit *Example*

Date & Time Issued		Date & time Expires	
Space I.D.		Supervisor	
Equipment Affected		Task	
Standby Team			
Pre-Entry Atmospheric Checks	Time (am - pm)		
	Oxygen		
	Explosive (% LEL)		
	Toxic (PPM)		
	Testers Signature		

Pre-entry Fluid System Isolation	Yes	No
Pumps /lines blinded, blocked, disconnected		
Ventilation Source Established		
Mechanical Forced Air		
Natural Ventilation		
Post Ventilation Pre-Entry Atmospheric Checks		
Time		
Oxygen (%)		
Explosive (% LEL		
Toxic (PPM)		
Tester Signature		
Communication Procedures Established per specific Confined Space SOP		
Rescue Procedures established per specific Confined Space SOP		

Training Verification - for the following persons & space to be entered	YES	NO
All persons entering Confined Space		
All persons acting as Supervisor for the Entry		
All persons assigned backup positions		
All persons assigned to monitor access and interior activities		
All persons assigned to emergency rescue team		

Equipment on Scene	YES	NO	NA		YES	NO	NA
Gas Monitor				Life Line			
Safety Harness				Hoisting Equipment			
Fall Arrest Gear				Powered Comm Eq.			

SCBAs				Air Line Respirators			
Protective Clothing				Elect Gear Properly Rated			

Periodic Atmospheric Checks				
Time (am - pm)				
Oxygen				
Explosive (% LEL)				
Toxic (PPM)				
Testers Signature				

A review of the work authorized by this permit and the information contained on this Entry Permit. Written instructions and safety procedures have been received and are understood. Entry cannot be approved if any squares are marked in the "**No**" column. This permit is not valid unless all appropriate items are completed.

Permit Prepared By: (Supervisor) ______________________________

Approved By: (Unit Supervisor) ________________________________

This permit to be kept at job site.
Return job site copy to Safety Office following job completion.

Copies: Safety Office, Unit Supervisor, Job site

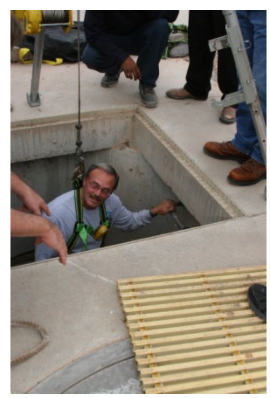
Confined Space Duties & Responsibilities

Examples of Assignments
Employees

- Follow program requirements.
- Report any previously un-identified hazards associated with confined spaces.
- Do not enter any confined spaces that have not been evaluated for safety concerns.

Management
- Provide annual Confined Space training to all employees that may need confined space training.
- Ensure confined space assessments have been conducted.
- Annually review this program and all Entry Permits.

Rescue or Training Department
- Ensure proper training for entry & rescue teams.
- Provide proper equipment for entry & rescue teams.
- Ensure all permit required confined spaces are posted.
- Evaluate rescue teams and service to ensure they are adequately trained and prepared.
- Ensure rescue team at access during entry into spaces with Immediately Dangerous to Life or Health (IDLH) atmospheres.
- Provide annual confined space awareness training to all employees that may need confined space awareness training.



Entry Supervisor
Entry supervisors are responsible for the overall permit space entry and must coordinate all entry procedures, tests, permits, equipment and other relevant activities.

The following entry supervisor duties are required:
Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure.

1. Verify by checking that the appropriate entries have been made on the permit, all tests specified by the permit have been conducted, and that all procedures and equipment specified by the permit are in place before endorsing the permit and allowing entry to begin.
2. Terminate the entry and cancel the permit when the entry is complete or there is a need for terminating the permit.
3. Verify that rescue services are available and that the means for summoning them are operable.

4. Remove unauthorized persons who enter or attempt to enter the space during entry operations.
5. Determine whenever responsibility for a permit space entry operation is transferred and at intervals dictated by the hazards and operations performed within the space that entry operations remain consistent with the permit terms and that acceptable entry conditions are maintained.

Entry Attendants

At least one attendant is required outside the permit space into which entry is authorized for the duration of the entry operation.

Responsibilities include:

- To know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure
- To be aware of possible behavioral effects of hazard exposure on entrants
- To continuously maintain an accurate count of entrants in the permit space and ensures a means to accurately identify authorized entrants
- To remain outside the permit space during entry operations until relieved by another attendant (once properly relieved, they may participate in other permit space activities, including rescue if they are properly trained and equipped).
- To communicate with entrants as necessary to monitor entrant status and alert entrants of the need to evacuate.
- To monitor activities inside and outside the space to determine if it is safe for entrants to remain in the space; orders the entrants to immediately evacuate if: the attendant detects a prohibited condition, detects entrant behavioral effects of hazard exposure, detects a situation outside the space that could endanger the entrants; or if the attendant cannot effectively and safely perform all the attendant duties.
- To summon rescue and other emergency services as soon as the attendant determines the entrants need assistance to escape the permit space hazards.
- To perform non-entry rescues as specified by that rescue procedure and entry supervisor and not to perform duties that might interfere with the attendants' primary duty to monitor and protect the entrants.

Most of this text is credited to OSHA.

Entering a Confined Space Procedures

This space requires an emergency retrieval system, continuous air monitoring, and safety watch or two-way communication for safe entry.

Donning the personal protective equipment (**PPE**) necessary for confined space entry.
The full-body harness provides fully adjustable leg and shoulder straps for worker comfort and proper fit. Stamped steel sliding back D-ring and sub-pelvic strap provide optimum force distribution.

Example of a "***D-Ring***" and fall protection harness used when entering a confined space. The D-Ring provides a compatible anchor point for connecting devices such as lanyards or retractable lifelines. The shock absorbing lanyard provides a deceleration distance during a fall to reduce fall arrest forces for extra protection against injury.

Tripod-retrieval assembly in use for an entry into one of the many confined spaces.

Checking the cable tension and inertial locking mechanism of the retrieval assembly.

Correct use of this device prevents free-falls greater than 2 feet.

The entrant descends into the space as the attendant critiques the operation.

Dramatic rescue simulation using the tripod-retrieval system.

The entrant is now safely out of the space and is ready to return to his many other projects after this simulated exercise.

Duties of the Person Authorizing or in Charge of the Entry

The person who authorizes or is in charge of the permit entry confined space must comply with the following:

1. Make certain that all pre-entry requirements as outlined on the permit have been completed before any worker is allowed to enter the confined space.

2. Make certain that any required pre-entry conditions are present.

3. If an in-plant/facility rescue team is to be used in the event of an emergency, make sure they would be available. If your Employer does not maintain an in-plant rescue team, dial 911 on any telephone for the Rescue Squad.

4. Make sure that any communication equipment which would be used to summon either the in-plant rescue team or other emergency assistance is operating correctly.

5. Terminate the entry upon becoming aware of a condition or set of conditions whose hazard potential exceeds the limits authorized by the entry permit.

If the person who would otherwise issue an entry permit is in charge of the entry and present during the entire entry, then a written permit is not required if that person uses a checklist as provided in the section on "***Permits***".

This person may also serve as the attendant at the site.

Special Considerations During A Permit Required Entry

Certain work being performed in a permit entry confined space could cause the atmosphere in the space to change.

Examples of this are welding, drilling, or sludge removal. In these situations, air monitoring of the confined space should be conducted on a continuous basis throughout the time of the entry.

If the workers leave the confined space for any significant period of time, such as for a lunch or other break, the atmosphere of the confined space must be retested before the workers reenter the confined space.

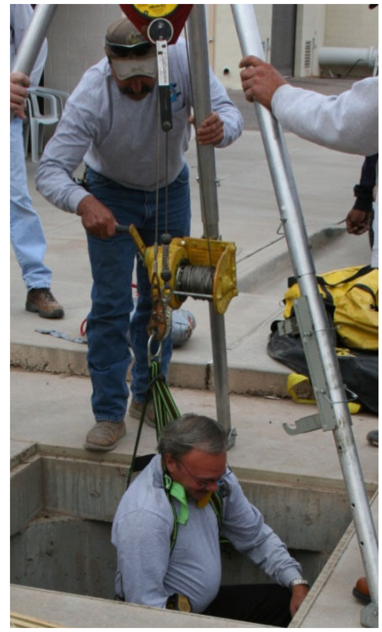
Unauthorized Persons

Take the following actions when unauthorized persons approach or enter a permit space while entry is under way:

1. Warn the unauthorized persons that they must stay away from the permit space,
2. Advise unauthorized persons that they must exit immediately if they have entered the space, and
3. Inform the authorized entrants and the entry supervisor if unauthorized persons have entered the permit space.

Entrants

All entrants must be authorized by the entry supervisor to enter permit spaces, have received the required training, have used the proper equipment, and observed the entry procedures and permit requirements.



The following entrant duties are required:
Know the hazards that may be faced during entry, including information on the mode, signs or symptoms, and consequences of the exposure;

Properly use the equipment required for safe entry;
Communicate with the attendant as necessary to enable the attendant to monitor the status of the entrants and to enable the attendant to alert the entrants of the need to evacuate the space if necessary;

Alert the attendant whenever; the entrant recognizes any warning signs or symptoms of exposure to a dangerous situation, or any prohibited condition is detected; and Exit the permit space as quickly as possible whenever the attendant or entry supervisor gives an order to evacuate the permit space, the entrant recognizes any warning signs or symptoms of exposure to a dangerous situation, the entrant detects a prohibited condition, or an evacuation alarm is activated.

Hazards

- ✓ Explosive / Flammable Atmospheres
- ✓ Toxic Atmospheres
- ✓ Engulfment
- ✓ Asphyxiation
- ✓ Entrapment
- ✓ Slips & falls
- ✓ Chemical Exposure
- ✓ Electric Shock
- ✓ Thermal / Chemical Burns
- ✓ Noise & Vibration

Hazard Control

Engineering Controls
- ➢ Locked entry points
- ➢ Temporary ventilation
- ➢ Temporary Lighting

Administrative Controls
- ➢ Signs
- ➢ Employee training
- ➢ Entry procedures
- ➢ Atmospheric Monitoring
- ➢ Rescue procedures
- ➢ Use of prescribed Personal Protective Equipment

Entry Standard Operating Procedures

This program outlines:
- ➢ Hazards
- ➢ Hazard Control & Abatement
- ➢ Acceptable Entry Conditions
- ➢ Means of Entry
- ➢ Entry Equipment Required
- ➢ Emergency Procedures

Permit Required Confined Space Entry General Rules

During all confined space entries, the following safety rules must be strictly enforced:

1. Only authorized and trained employees may enter a confined space or act as safety watchman/attendant.

2. No smoking is permitted in a confined space or near entrance/exit area.

3. During confined space entries, a watchman must be present at all times.

4. Constant visual or voice communication will be maintained between the safety watchman/attendant and employees entering a confined space.

5. No bottom or side entry will be made or work conducted below the level of any hanging material or material which could cause engulfment.

6. Air and oxygen monitoring is required before entering any permit-required confined space. Oxygen levels in a confined space must be between 19.5 and 23.5 percent. Levels above or below will require the use of an SCBA or other approved air supplied respirator.

Additional ventilation and oxygen level monitoring is required when welding is performed. The monitoring will check oxygen levels, explosive gas levels and carbon monoxide levels. Entry will not be permitted if explosive gas is detected above one-half the Lower Explosive Limit (**LEL**), or 10% of a specific gas explosive limit.

7. To prevent injuries to others, all openings to confined spaces will be protected by a barricade when covers are removed.

Confined Space Entry Procedures

Each employee who enters or is involved in the entry must:

1. Understand the procedures for confined space entry
2. Know the Hazards of the specific space
3. Review the specific procedures for each entry
4. Understand how to use entry and rescue equipment

Confined Space Entry Permits

- ✓ Confined Space Entry Permits must be completed before any employee enters a permit-required confined space. The permit must be completed and signed by an authorized member of management before entry.
- ✓ Permits will expire before the completion of the shift or if any pre-entry conditions change.
- ✓ Permits will be maintained on file for 12 months.

Contractor Entry

The latest trend is for the POTW to hire contractors to do certain parts or specialized work on the sewage system. If this is the case, you need to write a SOP for this type of work and confined space safety procedures for the contractor. All work by non-company employees that involves the entry into confined spaces will follow the procedures of this program. The information of this program and specific hazards of the confined spaces to be entered will be provided to contractor management prior to commencing entry or work.

Important Rescue Service Questions

What is the availability of the rescue service?

Is it unavailable at certain times of the day or in certain situations?

What is the likelihood that key personnel of the rescue service might be unavailable at times?

If the rescue service becomes unavailable while an entry is underway, does it have the capability of notifying the employer so that the employer can instruct the attendant to abort the entry immediately?

Required Confined Space Training

***Training for Confined Space Entry includes*:**

1. Duties of entry supervisor, entrant and attendants
2. Confined space entry permits
3. Hazards of confined spaces
4. Use of air monitoring equipment
5. First aid and CPR training
6. Emergency action & rescue procedures
7. Confined space entry & rescue equipment
8. Rescue training, including entry and removal from representative spaces

Confined Space Training and Education

OSHA's General Industry Regulation, §1910.146 Permit-required confined spaces, contains requirements for practices and procedures to protect employees in general industry from the hazards of entry into permit-required confined spaces. This regulation does not apply to construction.

OSHA's Construction Safety and Health Regulations Part 1926 do not contain a permit-required confined space regulation. Subpart C, §1926.21 Safety training and education specifies training for personnel who are required to enter confined spaces and defines a "***confined or enclosed space***." These requirements are shown below.

§1926.21 Safety training and education. (Partial)

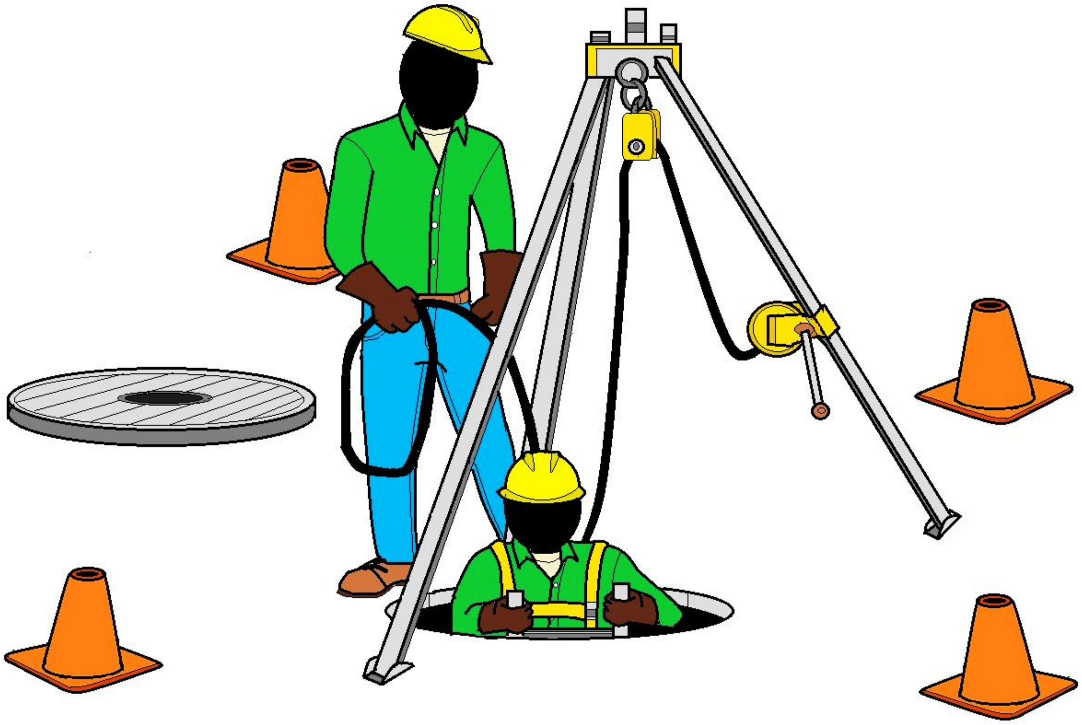
(b)(6)(i) All employees required to enter into confined or enclosed spaces shall be instructed as to the nature of the hazards involved, the necessary precautions to be taken, and in the use of protective and emergency equipment required. The employer shall comply with any specific regulations that apply to work in dangerous or potentially dangerous areas.

(ii) For purposes of paragraph (b)(6)(i) of this section, "***confined or enclosed space***" means any space having a limited means of egress, which is subject to the accumulation of toxic or flammable contaminants or has an oxygen deficient atmosphere. Confined or enclosed spaces include, but are not limited to, storage tanks, process vessels, bins, boilers, ventilation or exhaust ducts, sewers, underground utility vaults, tunnels pipelines, and open top spaces more than 4 feet in depth such as pits, tubs, vaults, and vessels.

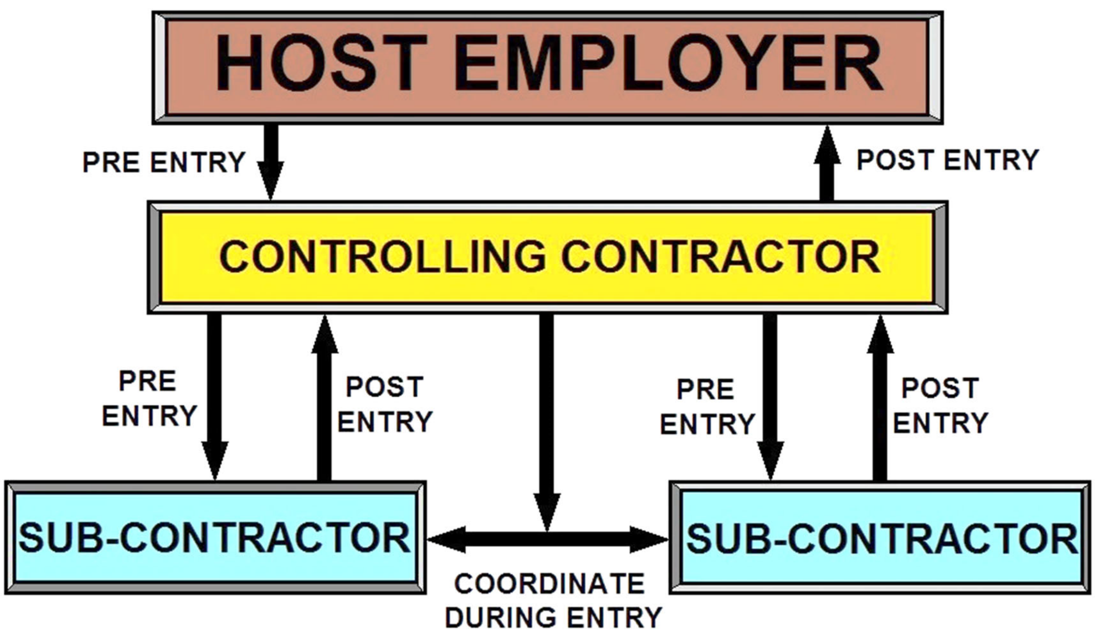
OSHA's Construction Regulations also contain requirements dealing with confined space hazards in underground construction (Subpart S), underground electric transmission and distribution work (§1926.956), excavations (Subpart P), and welding and cutting (Subpart J).

Further guidance may be obtained from American National Standard ANSI Z117.1-1989, Safety Requirements for Confined Spaces. This standard provides minimum safety requirements to be followed while entering, exiting and working in confined spaces at normal atmospheric pressure.

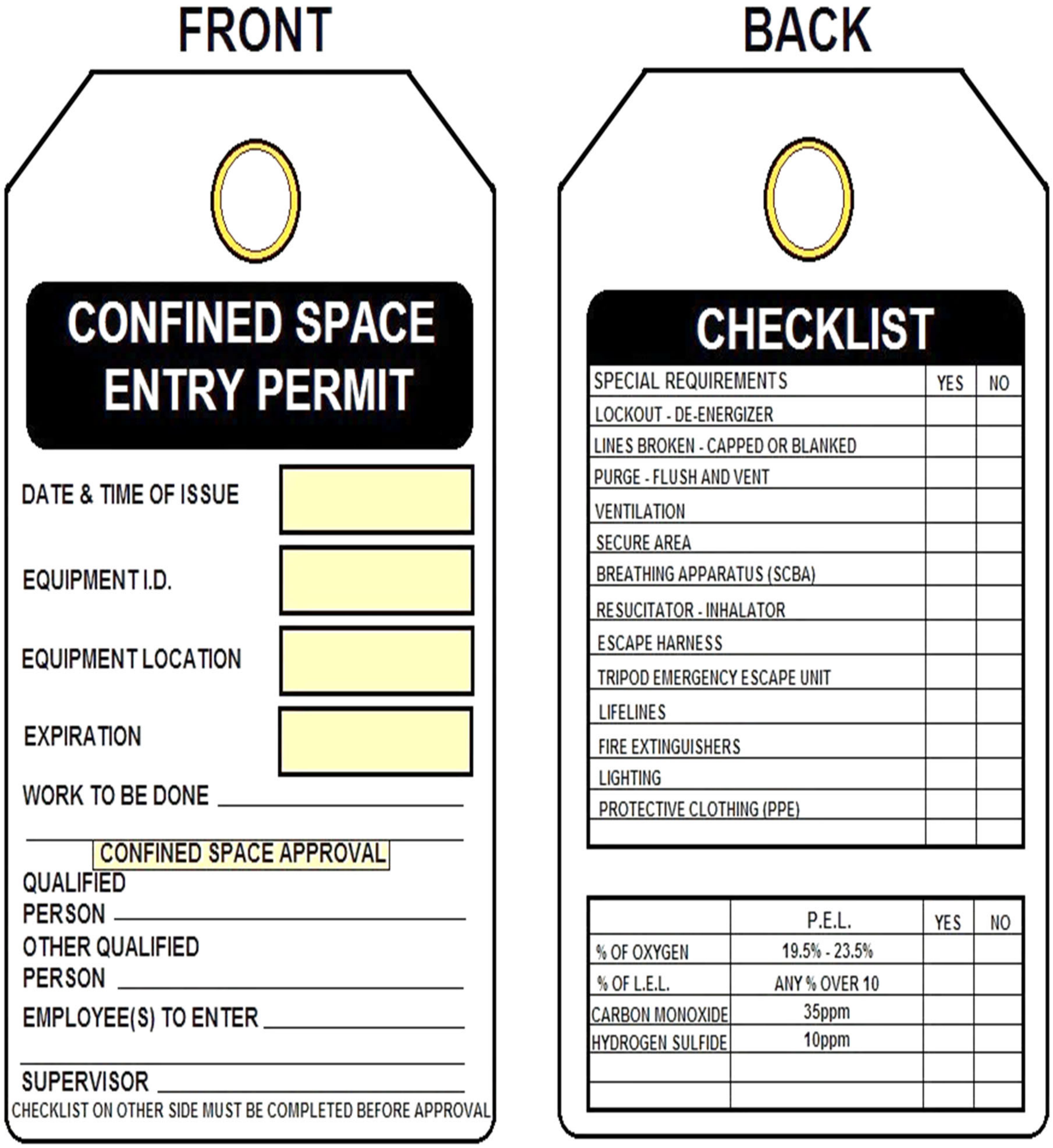
This standard does not pertain to underground mining, tunneling, caisson work or other similar tasks that have established national consensus standards.



ENTERING A CONFINED SPACE



COORDINATING CONFINED SPACE ENTRY ON JOBSITES



FRONT

CONFINED SPACE ENTRY PERMIT

DATE & TIME OF ISSUE

EQUIPMENT I.D.

EQUIPMENT LOCATION

EXPIRATION

WORK TO BE DONE ____________________

CONFINED SPACE APPROVAL

QUALIFIED PERSON ____________________

OTHER QUALIFIED PERSON ____________________

EMPLOYEE(S) TO ENTER ____________________

SUPERVISOR ____________________

CHECKLIST ON OTHER SIDE MUST BE COMPLETED BEFORE APPROVAL

BACK

CHECKLIST

SPECIAL REQUIREMENTS	YES	NO
LOCKOUT - DE-ENERGIZER		
LINES BROKEN - CAPPED OR BLANKED		
PURGE - FLUSH AND VENT		
VENTILATION		
SECURE AREA		
BREATHING APPARATUS (SCBA)		
RESUCITATOR - INHALATOR		
ESCAPE HARNESS		
TRIPOD EMERGENCY ESCAPE UNIT		
LIFELINES		
FIRE EXTINGUISHERS		
LIGHTING		
PROTECTIVE CLOTHING (PPE)		

	P.E.L.	YES	NO
% OF OXYGEN	19.5% - 23.5%		
% OF L.E.L.	ANY % OVER 10		
CARBON MONOXIDE	35ppm		
HYDROGEN SULFIDE	10ppm		

EXAMPLE OF A CONFINED SPACE TAG

The Employer is Responsible for Certain Training Requirements
These are as follows:

1. **GENERAL:** As an employer, your employer must ensure that all workers who must enter a permit entry confined space in the course of their work are informed of appropriate procedures and controls for entry into such spaces. These workers must be made aware of the fact that an unauthorized entry could be fatal, and that their senses are unable to detect and evaluate the severity of atmospheric hazards.

2. **TRAINING FOR AUTHORIZED ENTRANTS:** Your employer must ensure that all authorized entrants know the emergency action plan and have received training covering the following subjects prior to entering any permit entry confined space:

a**. Hazard Recognition**: Each worker must understand the nature of the hazard before entering and the need to perform appropriate testing to determine if it is safe to enter.

b. **Use of Personal Protective Equipment**: Each employee must be taught the proper use of all personal protective equipment required for entry or rescue, and the proper use of protective barriers and shields.

c. **Self-Rescue**: Each worker must be trained to get out of the confined space as rapidly as possible without help whenever an order to evacuate is given by the attendant, whenever an automatic evacuation alarm is activated, or whenever workers recognize the warning signs of exposure to substances that could be found in the confined space.

They must also be made aware of the toxic effects or symptoms of exposure to hazardous materials he could encounter in the confined space. This includes anything that could be absorbed through the skin or which could be carried through the skin by any solvents that are used. They must be trained to relay an alarm to the attendant and to attempt self- rescue immediately upon becoming aware of these effects.

d. **Special Work Practices or Procedures**: Each worker must be trained in any modifications of normal work practices that are necessary for permit entry confined space work.

3. **TRAINING FOR PERSONS AUTHORIZING OR IN CHARGE OF ENTRY** In addition to other requirements already covered, the person authorizing or in charge of entry shall be trained to recognize the effects of exposure to hazards that could be in the confined space. They must also carry out all duties that the permit assigns to them.

Rescue practice training. This photo is showing a sand bag being utilized as a dummy.

4. **TRAINING FOR ATTENDANT** Any worker functioning as an attendant at a permit entry confined space must be trained in the company's emergency action plan, the duties of the attendant, and in;

a. Proper use of the communications equipment furnished for communicating with authorized workers entering the confined space or for summoning emergency or rescue services.

b. Authorized procedures for summoning rescue or other emergency services.

c. Recognition of the unusual actions of a worker which could indicate that they could be experiencing a toxic reaction to contaminants that could be present in the space.

d. Any training for rescuers, if the attendant will function as a rescuer also.

e. Any training for workers who enter the confined space, if the permit specifies that the duty of the attendant will rotate among the workers authorized to enter the confined space.

CONFINED SPACE AUTHORIZED ENTRANT'S LOG EXAMPLE

CONFINED SPACE: **DATE:** **TIME:**

ENTRANT'S NAME (PRINT)	TIME IN	TIME OUT

ENTRY Attendant:

ENTRY Supervisor Review:

GAS METER CALIBRATION LOG

Meter # ______________________________

DATE	COMB (58) (52-64)	0_2 (15%) (13-17%)	CO (300) (290-310)	H_2S (10ppm) (9-12 ppm)	COMMENTS (SENSORS & BATTERIES)	INIT

Confined Space Entry Procedure List

Space _________________ Date Last Modified _____________

Place check mark in all applicable areas

	Hazards			**Personal Protective Equipment**
	Explosive / Combustion Hazard			Air supplied Respirator
	Exposed Electrical Circuits			Air Purifying Respirator
	Unguarded Machine Parts			Welding Protection
	Atmospheric Hazard			Gloves
	Potential Atmospheric Hazard			Hard Hat
	Thermal Hazard			**Ventilation Requirements**
	Chemical Hazard			Continuous ___cu.ft/min Note*: See Ventilation Guidelines for Confined Spaces for typical ventilation configurations and formulas.*
	Fall Hazard			
	Engulfment hazard		Note: *Additional ventilation may be required for hot work, grinding or other operations that would produce airborne fumes, mist or dust. Entry Supervisor must assess additional ventilation requirements base on tasks to be performed in the space*	
	Converging Walls			
	Floors slope-small cross-section			
	Slip Hazard			
	Entry Path			Vent Exhaust Point:
	Side entry			Vent Supply Point:
	Bottom entry			Space Volume
	Door			**Initial Purge Time=** 7.5 X ______ (space volume) Effective Blower Capacity
	Top open entry			
	Top manhole entry			**20 Air Changes per Hour (ACH) for duration of entry**
	Hinged hatch			**Minimum initial Purge Time= 20 Minutes**

Entry & Rescue Equipment				**Adequate Blower Capacity (ABC) = ________** $ABC = \frac{\text{Space Volume x 20 ACH}}{\text{60 minutes}}$
	Life Line			
	Floor level opening barrier		**Acceptable Entry Conditions**	
	Body Harness			Confined Space Entry permit posted
	Tripod			Oxygen 19.5 23.5%
	Man Winch			Lower Explosive Level %
	Fall Arrest Unit			Toxic fumes/vapors Less than PEL
	Emerg Retrieval Line			No engulfing material in space
	Atmospheric Monitor			No hazardous chemicals or material
	Blower /Saddle / Trunks			Drained - Flushed
	Drop Light			Rescue Team Available on Site
	Communication Gear			Ventilation Established & Maintained
	Ladder			LOTO Electrical components in space
	Hand held radios			LOTO Mechanical Components in space
	Portable Lighting			LOTO All pipes to and from space

Other Hazards

Flammable Atmospheres
A flammable atmosphere generally arises from enriched oxygen atmospheres, vaporization of flammable liquids, byproducts of work, chemical reactions, concentrations of combustible dusts, and desorption of chemical from inner surfaces of the confined space.

An atmosphere becomes flammable when the ratio of oxygen to combustible material in the air is neither too rich nor too lean for combustion to occur. Combustible gases or vapors will accumulate when there is inadequate ventilation in areas such as a confined space.

Flammable gases such as acetylene, butane, propane, hydrogen, methane, natural or manufactured gases or vapors from liquid hydrocarbons can be trapped in confined spaces, and since many gases are heavier than air, they will seek lower levels as in pits, sewers, and various types of storage tanks and vessels. In a closed top tank, it should also be noted that lighter than air gases may rise and develop a flammable concentration if trapped above the opening.

The byproducts of work procedures can generate flammable or explosive conditions within a confined space. Specific kinds of work such as spray painting can result in the release of explosive gases or vapors. Welding in a confined space is a major cause of explosions in areas that contain combustible gas.

Chemical reactions forming flammable atmospheres occur when surfaces are initially exposed to the atmosphere, or when chemicals combine to form flammable gases. This condition arises when dilute sulfuric acid reacts with iron to form hydrogen or when calcium carbide makes contact with water to form acetylene.

Other examples of spontaneous chemical reactions that may produce explosions from small amounts of unstable compounds are acetylene-metal compounds, peroxides, and nitrates. In a dry state, these compounds have the potential to explode upon percussion or exposure to increased temperature.

Another class of chemical reactions that form flammable atmospheres arise from deposits of pyrophoric substances (carbon, ferrous oxide, ferrous sulfate, iron, etc.) that can be found in tanks used by the chemical and petroleum industry. These tanks containing flammable deposits will spontaneously ignite upon exposure to air.

Combustible dust concentrations are usually found during the process of loading, unloading, and conveying grain products, nitrated fertilizers, finely ground chemical products, and any other combustible material.

High charges of static electricity, which rapidly accumulate during periods of relatively low humidity (below 50%) can cause certain substances to accumulate electrostatic charges of sufficient energy to produce sparks and ignite a flammable atmosphere.

These sparks may also cause explosions when the right air or oxygen to dust or gas mixture is present.

Toxic Atmospheres

The substances to be regarded as toxic in a confined space can cover the entire spectrum of gases, vapors, and finely-divided airborne dust in industry. The sources of toxic atmospheres encountered may arise from the following:

1. The manufacturing process (for example, in producing polyvinyl chloride, hydrogen chloride is used as well as vinyl chloride monomer, which is carcinogenic).
2. The product stored [removing decomposed organic material from a tank can liberate toxic substances, such as hydrogen sulfide (**H_2S**)].
3. The operation performed in the confined space (for example, welding or brazing with metals capable of producing toxic fumes).

During loading, unloading, formulation, and production, mechanical and/or human error may also produce toxic gases which are not part of the planned operation.

Carbon monoxide (**CO**) is a hazardous gas that may build up in a confined space. This odorless, colorless gas that has approximately the same density as air is formed from incomplete combustion of organic materials such as wood, coal, gas, oil, and gasoline; it can be formed from microbial decomposition of organic matter in sewers, silos, and fermentation tanks.

CO is an insidious toxic gas because of its poor warning properties. Early stages of CO intoxication are nausea and headache. CO may be fatal at as little as 1000 ppm or 10% in air, and is considered dangerous at 200 ppm or 2%, because it forms Carboxyhemoglobin in the blood which prevents the distribution of oxygen in the body.

CO is a relatively abundant colorless, odorless gas. Therefore, any untested atmosphere must be suspect. It must also be noted that a safe reading on a combustible gas indicator does not ensure that CO is not present. CO must be tested for specifically.

The formation of CO may result from chemical reactions or work activities, therefore fatalities due to CO poisoning are not confined to any particular industry. There have been fatal accidents in sewage treatment plants due to decomposition products and lack of ventilation in confined spaces.

Another area where CO results as a product of decomposition is in the formation of silo gas in grain storage elevators. In another area, the paint industry, varnish is manufactured by introducing the various ingredients into a kettle, and heating them in an inert atmosphere, usually town gas, which is a mixture of carbon dioxide and nitrogen.

Another poor work practice, which has led to fatalities, is the recirculation of diesel exhaust emissions. Increased CO levels can be prevented by strict control of the ventilation and the use of catalytic converters.

Procedures for Atmospheric Testing. - 1910.146 App B
OSHA Requirement

Sub-Part Title: General Environmental Controls

Atmospheric testing is required for two distinct purposes:
evaluation of the hazards of the permit space and verification that acceptable entry conditions for entry into that space exist.

(1) Evaluation testing. The atmosphere of a confined space should be analyzed using equipment of sufficient sensitivity and specificity to identify and evaluate any hazardous atmospheres that may exist or arise, so that appropriate permit entry procedures can be developed and acceptable entry conditions stipulated for that space.

Evaluation and interpretation of these data, and development of the entry procedure, should be done by, or reviewed by, a technically qualified professional (e.g., OSHA consultation service, or certified industrial hygienist, registered safety engineer, certified safety professional, certified marine chemist, etc.) based on evaluation of all serious hazards.

(2) Verification testing. The atmosphere of a permit space which may contain a hazardous atmosphere should be tested for residues of all contaminants identified by evaluation testing using permit specified equipment to determine that residual concentrations at the time of testing and entry are within the range of acceptable entry conditions.

Results of testing (i.e., actual concentration, etc.) should be recorded on the permit in the space provided adjacent to the stipulated acceptable entry condition.

(3) Duration of testing. Measurement of values for each atmospheric parameter should be made for at least the minimum response time of the test instrument specified by the manufacturer.

(4) Testing stratified atmospheres. When monitoring for entries involving a descent into atmospheres that may be stratified, the atmospheric envelope should be tested a distance of approximately 4 feet (1.22 m) in the direction of travel and to each side. If a sampling probe is used, the entrant's rate of progress should be slowed to accommodate the sampling speed and detector response.

(5) Order of testing. A test for oxygen is performed first because most combustible gas meters are oxygen dependent and will not provide reliable readings in an oxygen deficient atmosphere.

Combustible gases are tested for next because the threat of fire or explosion is both more immediate and more life threatening, in most cases, than exposure to toxic gases and vapors. If tests for toxic gases and vapors are necessary, they are performed last.

This is a ten-minute escape air pack or emergency air supply. The plastic bag will go over your head during an emergency and provide enough air to get out of the hole. There are smaller versions of this system available.

Atmospheric Testing Policy *Example*

Before entry, it is necessary to test the atmosphere in the confined space for oxygen levels, flammability, and/or any contaminants that have a potential to be present in that confined space. This testing must be done by a qualified person using equipment which has been approved for use in such areas.

The testing equipment itself should be checked to make sure it is working properly before using it. Follow the manufacturer's recommended procedures.

Testing of the confined spaces should be conducted throughout the entire portion of the space that workers will occupy during the entry. This testing shall be done without the use of ventilation systems.

Where the entry is vertical into the confined space, it is recommended that remote probes be used to measure the atmosphere at various levels. This is necessary because some gases and vapors are lighter or heavier than air and can accumulate at different levels in the confined space. Test outside the confined space to make sure the surrounding air is not contaminated.

Atmospheric conditions are considered unacceptable if oxygen levels are less than 19.5% or greater than 23.5%.

Regulations define the following unacceptable levels of other hazards monitored:

1. A flammable gas, vapor or mist greater than 10% of its lower flammable limit (**LFL**). LFL means the minimum concentration of the flammable material which will ignite if an ignition source is present.
2. An airborne combustible dust at a concentration that obscures vision at a distance of five feet or less.
3. An atmospheric concentration of a substance greater than the allowed limit in the Material Safety Data Sheet for that substance.

If test results conclude that the atmospheric condition of the confined space is unacceptable, entry is prohibited until such conditions are brought into acceptable limits. This may be done by purging, cleaning and/or ventilating the space.

Purging refers to the method by which gases, vapors, or other airborne impurities are displaced from a confined space.

The confined space may also be made non-flammable, non-explosive or otherwise chemically non-reactive by displacing or diluting the original atmosphere with steam or gas that is non-reactive with respect to that space, a process referred to as "***inerting***".

Irritant (Corrosive) Atmospheres

Irritant or corrosive atmospheres can be divided into primary and secondary groups. The primary irritants exert no systemic toxic effects (effects on the entire body).

Examples of primary irritants are chlorine, ozone, hydrochloric acid, hydrofluoric acid, sulfuric acid, nitrogen dioxide, ammonia, and sulfur dioxide. A secondary irritant is one that may produce systemic toxic effects in addition to surface irritation. Examples of secondary irritants include benzene, carbon tetrachloride, ethyl chloride, trichloroethane, trichloroethylene, and chloropropene.

Irritant gases vary widely among all areas of industrial activity. They can be found in plastics plants, chemical plants, the petroleum industry, tanneries, refrigeration industries, paint manufacturing, and mining operations.

Prolonged exposure at irritant or corrosive concentrations in a confined space may produce little or no evidence of irritation. This may result in a general weakening of the defense reflexes from changes in sensitivity. The danger in this situation is that the worker is usually not aware of any increase in his/her exposure to toxic substances.

Asphyxiating Atmospheres
The normal atmosphere is composed approximately of 20.9% oxygen and 78.1% nitrogen, and 1% argon with small amounts of various other gases. Reduction of oxygen in a confined space may be the result of either consumption or displacement.

The consumption of oxygen takes place during combustion of flammable substances, as in welding, heating, cutting, and brazing. A more subtle consumption of oxygen occurs during bacterial action, as in the fermentation process.

Oxygen may also be consumed during chemical reactions as in the formation of rust on the exposed surface of the confined space (iron oxide). The number of people working in a confined space and the amount of their physical activity will also influence the oxygen consumption rate.

A second factor in oxygen deficiency is displacement by another gas. Examples of gases that are used to displace air, and therefore reduce the oxygen level are helium, argon, and nitrogen.

Carbon dioxide may also be used to displace air and can occur naturally in sewers, storage bins, wells, tunnels, wine vats, and grain elevators.

Aside from the natural development of these gases, or their use in the chemical process, certain gases are also used as inerting agents to displace flammable substances and retard pyrophoric reactions.

Gases such as nitrogen, argon, helium, and carbon dioxide, are frequently referred to as non-toxic inert gases but have claimed many lives. The use of nitrogen to inert a confined space has claimed more lives than carbon dioxide.

The total displacement of oxygen by nitrogen will cause immediate collapse and death.

Carbon Dioxide
Carbon dioxide and argon, with specific gravities greater than air, may lie in a tank or manhole for hours or days after opening. Since these gases are colorless and odorless, they pose an immediate hazard to health unless appropriate oxygen measurements and ventilation are adequately carried out.

Oxygen Deprivation
Oxygen deprivation is one form of asphyxiation. While it is desirable to maintain the atmospheric oxygen level at 21% by volume, the body can tolerate deviation from this ideal. When the oxygen level falls to 17%, the first sign of hypoxia is deterioration to night vision, which is not noticeable until a normal oxygen concentration is restored.

Physiologic effects are increased breathing volume and accelerated heartbeat.

Between 14-16% physiologic effects are increased breathing volume, accelerated heartbeat, very poor muscular coordination, rapid fatigue, and intermittent respiration.

Between 6-10% the effects are nausea, vomiting, inability to perform, and unconsciousness. Less than 6%, the effects are spasmodic breathing, convulsive movements, and death in minutes.

Mechanical Hazards
If activation of electrical or mechanical equipment would cause injury, each piece of equipment should be manually isolated to prevent inadvertent activation before workers enter or while they work in a confined space. The interplay of hazards associated with a confined space, such as the potential of flammable vapors or gases being present, and the build-up of static charge due to mechanical cleaning, such as abrasive blasting, all influence the precautions which must be taken.

To prevent vapor leaks, flashbacks, and other hazards, workers should completely isolate the space. To completely isolate a confined space, the closing of valves is not sufficient.

All pipes must be physically disconnected or isolation blanks bolted in place. Other special precautions must be taken in cases where flammable liquids or vapors may re-contaminate the confined space.

The pipes blanked or disconnected should be inspected and tested for leakage to check the effectiveness of the procedure. Other areas of concern are steam valves, pressure lines, and chemical transfer pipes. A less apparent hazard is the space referred to as a void, such as double walled vessels, which must be given special consideration in blanking off and inerting.

Thermal Effects

Four factors influence the interchange of heat between people and their environment. They are: (1) air temperature, (2) air velocity, (3) moisture contained in the air, and (4) radiant heat. Because of the nature and design of most confined spaces, moisture content and radiant heat are difficult to control.

As the body temperature rises progressively, workers will continue to function until the body temperature reaches approximately 102°F.

When this body temperature is exceeded, the workers are less efficient, and are prone to heat exhaustion, heat cramps, or heat stroke. In a cold environment, certain physiologic mechanisms come into play, which tend to limit heat loss and increase heat production.

The most severe strain in cold conditions is chilling of the extremities so that activity is restricted. Special precautions must be taken in cold environments to prevent frostbite, trench foot, and general hypothermia.

Proper signage is essential to a proper safety program and can be part of the permit.

Required Confined Space Equipment Policy *Example*

Air Testing Equipment
All air-testing equipment should be calibrated in accordance with the manufacturer's instruction.

Oxygen Meters and Monitors
The oxygen content of the air in a confined space is the first and most important constituent to measure before entry is made. The acceptable range of oxygen is between 19.5 and 23.5 percent. This content is measured before flammability is tested because rich mixtures of flammable gases or vapors give erroneous measurement results.

For example, a mixture of 90 percent methane and 10 percent air will test nonflammable because there is not enough oxygen to support the combustion process in the flammability meters. This mixture will not support life and will soon become explosive if ventilation is provided to the space. Before entry, spaces must be ventilated until both oxygen content and flammability are acceptable.

Flammability Meters
Flammability meters are used to measure the amount of flammable vapors or gases in the atmosphere as a percent of the LEL/LFL. The oxygen content must be near 21 percent for results to be meaningful.

Toxic Air Contamination Testers
Tests for toxic contaminants must be specific for the target toxin. The instrument manufacturer should be consulted for interferences. Therefore, it is important to know the history of the confined space so proper tests can be performed. Part of hazard assessment is to identify all possible contaminants that could be in the confined space.

Protective Devices

Fall-Protection Equipment
Fall-protection equipment for confined spaces should be the chest-waist harness type to minimize injuries from uncontrolled movements when it arrests a worker's fall. This type of harness also permits easier retrieval from a confined space than a waist belt. Adjustable lanyards should be used to limit free fall to two feet before arrest.

Respirators
An industrial hygienist should select respirators on the basis of his or her evaluation of possible confined-space hazards. NIOSH-approved respirators should be identified in the approved procedure required by the confined-space entry permit. It is important to note that air-purifying respirators cannot be used in an oxygen deficient atmosphere.

Lockout/Tagout Devices
Lockout/tagout devices permit employees to work safely on de-energized equipment without fear that the devices will be accidentally removed. Lock and tag devices are required to withstand a 50-pound pull without failure.

Devices used to block or restrain stored mechanical energy devices must be engineered for safety.

Safety Barriers
Safety barriers separate workers from hazards that cannot reasonably be eliminated by other engineering controls.

Required barriers will be identified in the approved confined-space entry procedure.

Ground Fault Circuit Interrupters
Ground fault circuit interrupter must be used for all portable electrical tools and equipment in confined spaces because most workers will be in contact with grounded surroundings.

Emergency Response Equipment

Fire Extinguishers
"***Hot work***" inside a confined space requires that an approved fire extinguisher and a person trained in its use be stationed in the confined space or in a suitable vantage point where he or she could effectively suppress any fire that might result from the work.

First Aid Equipment
Blankets, first-aid kit, Stokes stretchers, and any other equipment that may be needed for first-response treatment must be available just outside the confined space. Medical and safety professionals should select equipment on the basis of their evaluations of the potential hazards in the confined space.

Retrieval Equipment
A tripod or another suitable anchorage, hoisting device, harnesses, wristlets, ropes, and any other equipment that may be needed to make a rescue must be identified in the confined-space safe-entry procedures.

It is important that this equipment be available for immediate use. Harnesses and retrieval ropes must be worn by entrants unless they would increase hazards to the entrants or impede their rescue.

Topic 12 – Confined Space Section Post Quiz

Confined space:
1. A confined space is large enough or so configured that an employee can _____________.

2. A confined space has limited or restricted means for _____________________.

3. A confined space is not designed for ______________________.

4. A permit required confined space (permit space) contains or has a potential to contain a ____________________.

5. A permit required confined space (permit space) has an internal configuration such that _______________ could be trapped or asphyxiated by inwardly converging walls or by a floor which slopes downward and tapers to a smaller cross-section.

6. A permit required confined space (permit space) contains any other recognized serious safety or ________________.

7. Each _______________________ must be marked "Confined Space - Entry Permit Required".

Confined Space Hazards
8. Fatalities and injuries constantly occur among construction workers who are required to enter __________________.

9. Workers encounter both inherent and _______________ within confined workspaces.

Inherent Hazards
10. ______________ are associated with specific types of equipment and the interactions among them. These hazards can be electrical, thermal, chemical, mechanical, etc.

11. Inherent hazards include high voltage, radiation generated by equipment, ___________, omission of protective features, high or low temperatures, high noise levels, and high-pressure vessels and lines.

12. Inherent hazards usually cannot be eliminated without degrading or shutting down the system or equipment. Therefore, emphasis must be placed on __________________.

Induced Hazards
13. ________________ result from a multitude of incorrect decisions and actions that occur during the actual construction process.

14. Some examples of induced hazards are: omission of protective features, physical arrangements that may cause unintentional worker contact with electrical energy sources, oxygen-deficient atmospheres created at the bottom of pits or shafts, lack of safety factors in structural strength, and ______________________.

Typical Examples of Confined Workspaces
15. Confined workspaces in construction contain_____________________.

Vaults
16. Workers must enter ________________ found on the construction jobsite to perform a number of functions.

17. The restricted nature of vaults and their frequently ________________ are reasons that vaults have an assortment of safety and health problems.

Oxygen-Deficient Atmosphere
18. The ever-present possibility of ______________________ is one of the major problems confronting construction workers while working in vaults.

Manholes
19. Manholes are necessary to provide a means of entry into and exit from vaults, tanks, and pits, but these confined spaces may present _________________ which could cause injuries and fatalities.

20. __________________ are associated with manholes. For example, workers could fall into manholes when covers are missing.

Glossary

2,4-D: A chlorinated phenoxy compound, functions as a systemic herbicide and is used to control many types of broadleaf weeds. There are many forms or derivatives (esters, amines, salts) of 2,4-D and these vary in solubility and volatility. Unless otherwise specified, this document will refer to the acid form of 2,4-D. This compound is used in cultivated agriculture and in pasture and rangeland applications, forest management, home and garden situations and for the control of aquatic vegetation. 2,4-D was a major component (about 50%) of the product Agent Orange used extensively throughout Vietnam. However most of the problems associated with the use of Agent Orange were associated with a contaminant (dioxin) in the 2,4,5-T component of the defoliant. The association of 2,4-D with Agent Orange has prompted a vast amount of study on the herbicide.
ABIOGENESIS: The concept of spontaneous generation (that life can come from non-life). This idea was refuted by Pasteur.
ABIOTIC: The non-living components of an organism's environment. The term abiotic is also used to denote a process which is not facilitated by living organisms.
ABORAL: Pertaining to the region of the body opposite that of the mouth. Normally used to describe radially symmetrical animals.
ABSCISIC ACID (ABA): A plant hormone that generally acts to inhibit growth, promote dormancy, and help the plant withstand stressful conditions.
ABSENCE OF OXYGEN: The complete absence of oxygen in water described as Anaerobic.
ABSORPTION SPECTRUM: The range of a material's ability to absorb various wavelengths of light. The absorption spectrum is studied to evaluate the function of photosynthetic pigments.
ACCURACY: How closely an instrument measures the true or actual value.
ACID ADDITION: Slowly add the acid to water while stirring. An operator should not mix acid and water or acid to a strong base.
ACID AND BASE ARE MIXED: When an acid and a base are mixed, an explosive reaction occurs and decomposition products are created under certain conditions.
ACID RAIN: Rain that is excessively acidic due to the presence of acid: causing pollutants in the atmosphere. Pollutants include nitrogen and sulfur oxides due to burning of coal and oil.
ACID: n **acid** is a molecule or ion capable of donating a hydron (proton or hydrogen ion H^+), or, alternatively, capable of forming a covalent bond with an electron pair (a Lewis acid). The first category of acids is the proton donors or Brønsted acids. In the special case of aqueous solutions, proton donors form the hydronium ion H_3O^+ and are known as Arrhenius acids. Brønsted and Lowry generalized the Arrhenius theory to include non-aqueous solvents. A Brønsted or Arrhenius acid usually contains a hydrogen atom bonded to a chemical structure that is still energetically favorable after loss of H^+.
ACIDOSIS: A condition whereby the hydrogen ion concentration of the tissues is increased (and pH decreased). Respiratory acidosis is due to the retention of CO_2; metabolic acidosis by retention of acids due either to kidney failure or diarrhea.
ACTIVATED SLUDGE PROCESS: A biological wastewater treatment process in which a mixture of wastewater and biologically enriched sludge is mixed and aerated to facilitate aerobic decomposition by microbes.
ACTIVATED SLUDGE: The biologically active solids in an activated sludge process wastewater treatment plant.
ACTIVATING ENZYME: An enzyme that couples a low-energy compound with ATP to yield a high-energy derivative.
ACTIVATION ENERGY: In a chemical reaction, the initial investment required to energize the bonds of the reactants to an unstable transition state that precedes the formation of the products.
ACTIVE SITE: That specific portion of an enzyme that attaches to the substrate by means of weak chemical bonds.
ACTIVE TRANSPORT: The movement of a substance across a biological membrane against its concentration or electrochemical gradient with the help of energy input and specific transport proteins.
ADAPTATION: Any genetically controlled characteristic that increases an organism's fitness, usually by helping the organism to survive and reproduce in the environment it inhabits.
ADAPTIVE RADIATION: This refers to the rapid evolution of one or a few forms into many different species that occupy different habitats within a new geographical area.
ADHESION: In chemistry, the phenomenon whereby one substance tends to cling to another substance. Water molecules exhibit adhesion, especially toward charged surfaces.
ADP (Adenosine diphosphate): A doubly phosphorylated organic compound that can be further phosphorylated to form ATP.
ADRENAL GLAND: An endocrine gland located adjacent to the kidney in mammals. It is composed of an outer cortex, and a central medulla, each involved in different hormone: mediated phenomena.
ADRENALIN: A hormone produced by the pituitary that stimulates the adrenal cortex.
ADSORB: Hold on a surface.
ADSORPTION: *Not to be confused with absorption.* Adsorption is a process that occurs when a gas or liquid solute accumulates on the surface of a solid or a liquid (adsorbent), forming a film of molecules or atoms (the adsorbate). It is different from absorption, in which a substance diffuses into a liquid or solid to form a solution. The term sorption

encompasses both processes, while desorption is the reverse process. Adsorption is present in many natural physical, biological, and chemical systems, and is widely used in industrial applications such as activated charcoal, synthetic resins, and water purification. Adsorption, ion exchange, and chromatography are sorption processes in which certain adsorbates are selectively transferred from the fluid phase to the surface of insoluble, rigid particles suspended in a vessel or packed in a column. Similar to surface tension, adsorption is a consequence of surface energy. In a bulk material, all the bonding requirements (be they ionic, covalent, or metallic) of the constituent atoms of the material are filled by other atoms in the material. However, atoms on the surface of the adsorbent are not wholly surrounded by other adsorbent atoms, and therefore can attract adsorbates. The exact nature of the bonding depends on the details of the species involved, but the adsorption process is generally classified as physisorption (characteristic of weak van der Waals forces) or chemisorption (characteristic of covalent bonding).
AERATION: The addition of air or oxygen to water or wastewater, usually by mechanical means, to increase dissolved oxygen levels and maintains aerobic conditions.
AEROBIC DIGESTION: Sludge stabilization process involving direct oxidation of biodegradable matter and oxidation of microbial cellular material.
AEROBIC: The condition of requiring oxygen; an aerobe is an organism which can live and grow only in the presence of oxygen.
AIR ENTRAINMENT: The dissolution or inclusion of air bubbles into water.
AIR GAP SEPARATION: A physical separation space that is present between the discharge vessel and the receiving vessel; for an example, a kitchen faucet.
ALCOHOL: Any of a class of organic compounds in which one or more - OH groups are attached to a carbon compound.
ALDEHYDE: An organic molecule with a carbonyl group located at the end of the carbon skeleton.
ALGAE: Microscopic plants that are free-living and usually live in water. They occur as single cells floating in water, or as multicellular plants like seaweed or strands of algae that attach to rocks.
ALKALINE: Having a pH of more than 7. Alkaline solutions are also said to be basic.
ALKALINITY: Alkalinity or AT is a measure of the ability of a solution to neutralize acids to the equivalence point of carbonate or bicarbonate. Alkalinity is closely related to the acid neutralizing capacity (ANC) of a solution and ANC is often incorrectly used to refer to alkalinity. However, the acid neutralizing capacity refers to the combination of the solution and solids present (e.g., suspended matter, or aquifer solids), and the contribution of solids can dominate the ANC (see carbonate minerals below). The alkalinity is equal to the stoichiometric sum of the bases in solution. In the natural environment carbonate alkalinity tends to make up most of the total alkalinity due to the common occurrence and dissolution of carbonate rocks and presence of carbon dioxide in the atmosphere. Other common natural components that can contribute to alkalinity include borate, hydroxide, phosphate, silicate, nitrate, dissolved ammonia, the conjugate bases of some organic acids and sulfide. Solutions produced in a laboratory may contain a virtually limitless number of bases that contribute to alkalinity. Alkalinity is usually given in the unit mEq/L (milliequivalent per liter). Commercially, as in the pool industry, alkalinity might also be given in the unit ppm or parts per million. Alkalinity is sometimes incorrectly used interchangeably with basicity. For example, the pH of a solution can be lowered by the addition of CO_2. This will reduce the basicity; however, the alkalinity will remain unchanged.
ALLANTOIS: One of the four extraembryonic membranes found associated with developing vertebrates; it serves in gas exchange and as a repository for the embryo's nitrogenous waste. In humans, the allantois is involved in early blood formation and development of the urinary bladder.
ALLELE: Alternate forms of a gene which may be found at a given location (locus) on members of a homologous set of chromosomes. Structural variations between alleles may lead to different phenotypes for a given trait.
ALLOMETRIC: The variation in the relative rates of growth of various parts of the body, which helps shape the organism.
ALLOSTERIC ENZYME: An enzyme that can exist in two or more conformations.
ALPHA AND BETA RADIOACTIVITY: Represent two common forms of radioactive decay. Radioactive elements have atomic nuclei so heavy that the nucleus will break apart, or disintegrate spontaneously. When decay occurs, high-energy particles are released. These high-energy particles are called radioactivity. Although radioactivity from refined radioactive elements can be dangerous, it is rare to find dangerous levels of radioactivity in natural waters. An alpha particle is a doubly-charged helium nucleus comprised of two protons, two neutrons, and no electrons. A beta particle is a high-speed electron. Alpha particles do not penetrate matter easily, and are stopped by a piece of paper. Beta particles are much more penetrating and can pass through a millimeter of lead.
ALPHA EMITTERS: Certain minerals are radioactive and may emit a form of radiation known as alpha radiation. Some people who drink water containing alpha emitters in excess of the EPA standard over many years may have an increased risk of getting cancer.
ALPHA HELIX: A spiral shape constituting one form of the secondary structure of proteins, arising from a specific hydrogen: bonding structure.
ALTERNATION OF GENERATIONS: Occurrences of a multicellular diploid form, the sporophyte, with a multicellular haploid form, the gametophyte.

ALTERNATIVE DISINFECTANTS: Disinfectants - other than chlorination (halogens) - used to treat water, e.g. ozone, ultraviolet radiation, chlorine dioxide, and chloramine. There is limited experience and scientific knowledge about the by-products and risks associated with the use of alternatives.
ALTRUISM: The willingness of an individual to sacrifice its fitness for the benefit of another.
ALUMINUM SULFATE: The chemical name for Alum. The molecular formula of Alum is $Al_2(SO_4)3{\sim}14H_2O$. It is a cationic polymer.
ALVEOLUS: One of the dead-end, multilobed air sacs that constitute the gas exchange surface of the lungs.
AMINO ACID: An organic molecule possessing a carboxyl (COOH) and amino group. Amino acids serve as the monomers of polypeptides and proteins.
AMINO GROUP: A functional group consisting of a nitrogen atom bonded to two hydrogens; can act as a base in solution, accepting a hydrogen ion and acquiring a charge of +1.
AMINOACYL: tRNA synthetases- A family of enzymes, at least one for each amino acid, that catalyze the attachment of an amino acid to its specific tRNA molecule.
AMMONIA: A chemical made with Nitrogen and Hydrogen and used with chlorine to disinfect water. Most ammonia in water is present as the ammonium ion rather than as ammonia.
AMOEBA: Amoeba (sometimes amœba or ameba, plural amoebae) is a genus of protozoa that moves by means of pseudopods, and is well-known as a representative unicellular organism. The word amoeba or ameba is variously used to refer to it and its close relatives, now grouped as the Amoebozoa, or to all protozoa that move using pseudopods, otherwise termed amoeboids.
AMOEBOID: (cell) A cell which has the tendency to change shape by protoplasmic flow. (movement) A streaming locomotion characteristic of Amoeba and other protists, as well as some individual cells, such as white blood cells, in animals.
AMP (Adenosine monophosphate): A singly phosphorylated organic compound that can be further phosphorylated to form ADP.
AMYLASE: A starch-digesting enzyme.
ANABOLISM: A metabolic pathway of biosynthesis that consumes energy to build a large molecule from simpler ones.
ANAEROBIC CONDITIONS: When anaerobic conditions exist in either the metalimnion or hypolimnion of a stratified lake or reservoir, water quality problems may make the water unappealing for domestic use without costly water treatment procedures. Most of these problems are associated with Reduction in the stratified waters.
ANAEROBIC DIGESTION: Sludge stabilization process where the organic material in biological sludges are converted to methane and carbon dioxide in an airtight reactor.
ANAEROBIC: Without oxygen. An organism that lives in the absence of oxygen is called an anaerobe. An abnormal condition in which color and odor problems are most likely to occur.
ANAGENESIS: A pattern of evolutionary change involving the transformation of an entire population, sometimes to a state different enough from the ancestral population to justify renaming it as a separate species; also called phyletic.
ANALOGOUS: Characteristics of organisms that are similar in function (and often in structure) but different in embryological and/or evolutionary origins.
ANALYST: The analyst must have at least 2 years of college lecture and laboratory course work in microbiology or a closely related field. The analyst also must have at least 6 months of continuous bench experience with environmental protozoa detection techniques and IFA microscopy, and must have successfully analyzed at least 50 water and/or wastewater samples for *Cryptosporidium* and *Giardia*. Six months of additional experience in the above areas may be substituted for two years of college.
ANCESTRAL TRAIT: Trait shared by a group of organisms as a result of descent from a common ancestor.
ANEUPLOIDY: A chromosomal aberration in which certain chromosomes are present in extra copies or are deficient in number.
ANION: A negatively charged ion.
ANISOGAMOUS: Reproducing by the fusion of gametes that differ only in size, as opposed to gametes that are produced by oogamous species. Gametes of oogamous species, such as egg cells and sperm, are highly differentiated.
ANOXIC: A biological environment that is deficient in molecular oxygen, but may contain chemically bound oxygen, such as nitrates and nitrites.
ANTERIOR: Referring to the head end of a bilaterally symmetrical animal.
ANTHROPOMORPHISM: Attributing a human characteristic to an inanimate object or a species other than a human.
ANTIBIOTIC: A chemical that kills or inhibits the growth of bacteria, often via transcriptional or translational regulation.
ANTIDIURETIC HORMONE: A hormone important in osmoregulation (it acts to reduce the elimination of water from the body.
ANTIGEN: A foreign macromolecule that does not belong to the host organism and that elicits an immune response.
ANTIMONY: A chemical element with the symbol Sb (Latin: stibium, meaning "mark") and atomic number 51. A metalloid, antimony has four allotropic forms. The stable form of antimony is a blue-white metalloid. Yellow and black

antimony are unstable non-metals. Antimony is used in flame-proofing, paints, ceramics, enamels, a wide variety of alloys, electronics, and rubber.
APOMORPHIC CHARACTER: A derived phenotypic character, or homology, that evolved after a branch diverged from a phylogenetic tree.
APOSEMATIC COLORATION: Serving as a warning, with reference particularly to colors and structures that signal possession of defensive device.
AQUEOUS SOLUTION: A solution in which water is the solvent.
ARCHAEBACTERIA: A lineage of prokaryotes, represented today by a few groups of bacteria inhabiting extreme environments. Some taxonomists place archaebacteria in their own kingdom, separate from the other bacteria.
ARCHENTERON: The endoderm-lined cavity formed during the gastrulation process that develops into the digestive tract of the animal.
ARISTOTLE: A Greek philosopher often credited as the first to use empirical and deductive methods in logic.
ARTIFICIAL SELECTION: The selective breeding of domesticated plants and animals to encourage the occurrence of desirable traits.
AS NITROGEN: An expression that tells how the concentration of a chemical is expressed mathematically. The chemical formula for the nitrate ion is NO3 , with a mass of 62. The concentration of nitrate can be expressed either in terms of the nitrate ion or in terms of the principal element, nitrogen. The mass of the nitrogen atom is 14. The ratio of the nitrate ion mass to the nitrogen atom mass is 4.43. Thus a concentration of 10 mg/L nitrate expressed as nitrogen would be equivalent to a concentration of 44.3 mg/L nitrate expressed as nitrate ion. When dealing with nitrate numbers it is very important to know how numeric values are expressed.
AS: The chemical symbol of Arsenic.
ASCUS: The elongate spore sac of a fungus of the Ascomycota group.
ASEXUAL: A type of reproduction involving only one parent that produces genetically identical offspring by budding or division of a single cell or the entire organism into two or more parts.
ASSORTATIVE MATING: A type of nonrandom mating in which mating partners resemble each other in certain phenotypic characters.
ASYMMETRIC CARBON: A carbon atom covalently bonded to four different atoms or groups of atoms.
ATOM: The general definition of an ion is an atom with a positive or negative charge. Electron is the name of a negatively charged atomic particle.
ATOMIC NUMBER: The number of protons in the nucleus of an atom, unique for each element.
ATOMIC THEORY: The physical theory of the structure, properties and behavior of the atom.
ATOMIC WEIGHT: The total atomic mass, which is the mass in grams of one mole of the atom (relative to that of 12C, which is designated as 12).
ATP (Adenosine triphosphate): A triply phosphorylated organic compound that functions as "energy currency" for organisms, thus allowing life forms to do work; it can be hydrolyzed in two steps (first to ADP and then to AMP) to liberate 7.3 Kcal of energy per mole during each hydrolysis.
ATPASE: An enzyme that functions in producing or using ATP.
AUTOGENOUS MODEL: A hypothesis which suggests that the first eukaryotic cells evolved by the specialization of internal membranes originally derived from prokaryotic plasma membranes.
AUTOIMMUNE DISEASE: An immunological disorder in which the immune system goes awry and turns against itself.
AUTOPOLYPLOID: A type of polyploid species resulting from one species doubling its chromosome number to become tetraploids, which may self-fertilize or mate with other tetraploids.
AUTOSOME: Chromosomes that are not directly involved in determining sex.
AUTOTROPH: An organism which is able to make organic molecules from inorganic ones either by using energy from the sun or by oxidizing inorganic substances.
AUXIN: One of several hormone compounds in plants that have a variety of effects, such as phototropic response through stimulation of cell elongation, stimulation of secondary growth, and development of leaf traces and fruit.
AUXOTROPH: A nutritional mutant that is unable to synthesize and that cannot grow on media lacking certain essential molecules normally synthesized by wild-type strains of the same species.
AXON: A typically long outgrowth, or process, from a neuron that carries nerve impulses away from the cell body toward target cells.
AXONEME: An internal flagellar structure that occurs in some protozoa, such as *Giardia*, *Spironucleous*, and *Trichonmonas*.

B

BACKFLOW PREVENTION: To stop or prevent the occurrence of, the unnatural act of reversing the normal direction of the flow of liquid, gases, or solid substances back in to the public potable (drinking) water supply. See Cross-connection control.
BACKFLOW: To reverse the natural and normal directional flow of a liquid, gases, or solid substances back in to the public potable (drinking) water supply. This is normally an undesirable effect.
BACKSIPHONAGE: A liquid substance that is carried over a higher point. It is the method by which the liquid substance may be forced by excess pressure over or into a higher point.

BACTERIA: Small, one-celled animals too small to be seen by the naked eye. Bacteria are found everywhere, including on and in the human body. Humans would be unable to live without the bacteria that inhabit the intestines and assist in digesting food. Only a small percentage of bacteria cause disease in normal, healthy humans. Other bacteria can cause infections if they get into a cut or wound. Bacteria are the principal concern in evaluating the microbiological quality of drinking water, because some of the bacteria-caused diseases that can be transmitted by drinking water are potentially life-threatening.
BACTERIOPHAGE: A bacteriophage (from 'bacteria' and Greek phagein, 'to eat') is any one of a number of viruses that infect bacteria. The term is commonly used in its shortened form, phage. Typically, bacteriophages consist of an outer protein hull enclosing genetic material. The genetic material can be ssRNA (single stranded RNA), dsRNA, ssDNA, or dsDNA between 5 and 500 kilo base pairs long with either circular or linear arrangement. Bacteriophages are much smaller than the bacteria they destroy - usually between 20 and 200 nm in size.
BACTERIUM: A unicellular microorganism of the Kingdom Monera. Bacteria are prokaryotes; their cells have no true nucleus. Bacteria are classified into two groups based on a difference in cell walls, as determined by Gram staining.
BALANCED POLYMORPHISM: A type of polymorphism in which the frequencies of the coexisting forms do not change noticeably over many generations.
BARIUM: A chemical element. It has the symbol Ba, and atomic number 56. Barium is a soft silvery metallic alkaline earth metal. It is never found in nature in its pure form due to its reactivity with air. Its oxide is historically known as baryta but it reacts with water and carbon dioxide and is not found as a mineral. The most common naturally occurring minerals are the very insoluble barium sulfate, BaSO4 (barite), and barium carbonate, BaCO3 (witherite). Benitoite is a rare gem containing barium.
BARR BODY: The dense object that lies along the inside of the nuclear envelope in cells of female mammals, representing the one inactivated X chromosome.
BASAL BODY: A cell structure identical to a centriole that organizes and anchors the microtubule assembly of a cilium or flagellum.
BASE PAIRING: Complementary base pairing refers to the chemical affinities between specific base pairs in a nucleic acid: adenine always pairs with thymine, and guanine always pairs with cytosine. In pairing between DNA and RNA, the uracil of RNA always pairs with adenine. Complementary base pairing is not only responsible for the DNA double helix, but it is also essential for various in vitro techniques such as PCR (polymerase chain reaction). Complementary base pairing is also known as Watson-Crick pairing.
BASE: A substance that reduces the hydrogen ion concentration in a solution.
BASEMENT MEMBRANE: The floor of an epithelial membrane on which the basal cells rest.
B-CELL LYMPHOCYTE: A type of lymphocyte that develops in the bone marrow and later produces antibodies, which mediate humoral immunity.
BELT PRESS: A dewatering device utilizing two opposing synthetic fabric belts, revolving over a series of rollers to “squeeze” water from the sludge.
BENCH TEST: A small-scale test or study used to determine whether a technology is suitable for a particular application.
BENIGN TUMOR: A noncancerous abnormal growth composed of cells that multiply excessively but remain at their place of origin in the body.
BENTHIC: Pertaining to the bottom region of an aquatic environment.
BERYLLIUM: A chemical element with the symbol Be and atomic number 4. A bivalent element, beryllium is a steel grey, strong, light-weight yet brittle alkaline earth metal. It is primarily used as a hardening agent in alloys, most notably beryllium copper. Commercial use of beryllium metal presents technical challenges due to the toxicity (especially by inhalation) of beryllium-containing dusts.
BEST AVAILABLE TECHNOLOGY ECONOMICALLY ACHIEVABLE (BAT): A level of technology based on the best existing control and treatment measures that are economically achievable within the given industrial category or subcategory.
BEST MANAGEMENT PRACTICES (BMPs): Schedules of activities, prohibitions of practices, maintenance procedures, and other management practices to prevent or reduce the pollution of waters of the U.S. BMPs also include treatment requirements, operating procedures and practices to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw material storage.
BEST PRACTICABLE CONTROL TECHNOLOGY CURRENTLY AVAILABLE (BPT): A level of technology represented by the average of the best existing wastewater treatment performance levels within an industrial category or subcategory.
BEST PROFESSIONAL JUDGMENT (BPJ): The method used by a permit writer to develop technology-based limitations on a case-by-case basis using all reasonably available and relevant data.
BETA PLEATED SHEET: A zigzag shape, constituting one form of the secondary structure of proteins formed of hydrogen bonds between polypeptide segments running in opposite directions.
BETA/PHOTON EMITTER: Certain minerals are radioactive and may emit forms of radiation known as photons and beta radiation. Some people who drink water containing beta and photon emitters in excess of the EPA standard over many years may have an increased risk of getting cancer.

BILATERAL SYMMETRY: The property of having two similar sides, with definite upper and lower surfaces and anterior and posterior ends. The Bilateria are members of the branch of Eumetazoa (Kingdom Animalia) which possess bilateral symmetry.
BILE: A mixture of substances containing bile salts, which emulsify fats and aid in their digestion and absorption.
BINARY FISSION: The kind of cell division found in prokaryotes, in which dividing daughter cells each receive a copy of the single parental chromosome.
BINOMIAL NOMENCLATURE: Consisting of two names. In biology, each organism is given a *genus* name and a species name (i.e., the human is Homo sapiens.
BIOCHEMICAL OXYGEN DEMAND (BOD): The BOD test is used to measure the strength of wastewater. The BOD of wastewater determines the milligrams per liter of oxygen required during stabilization of decomposable organic matter by aerobic bacteria action. Also, the total milligrams of oxygen required over a five-day test period to biologically assimilate the organic contaminants in one liter of wastewater maintained at 20 degrees Centigrade.
BIOGENESIS: A central concept of biology, that living organisms are derived from other living organisms (contrasts to the concept of abiogenesis, or spontaneous generation, which held that life could be derived from inanimate material).
BIOLOGICAL MAGNIFICATION: Increasing concentration of relatively stable chemicals as they are passed up a food chain from initial consumers to top predators.
BIOMASS: The total weight of all the organisms, or of a designated group of organisms, in a given area
BIOME: A large climatic region with characteristic sorts of plants and animals.
BIOSOLIDS: Solid organic matter recovered from municipal wastewater treatment that can be beneficially used, especially as a fertilizer. “Biosolids” are solids that have been stabilized within the treatment process, whereas “sludge” has not.
BIOSPHERE: The region on and surrounding the earth which is capable of supporting life. Theoretically, the concept may be ultimately expanded to include other regions of the universe.
BMR: The basal metabolic rate is the minimal energy (in kcal) required by a homeotherm to fuel itself for a given time. Measured within the thermoneutral zone for a postabsorptive animal at rest.
BODY FEED: Coating or bulking material added to the influent of material to be treated. This adds “body” to the material during filtration cycle.
Both measurements (mg/L or KH) are usually expressed "as $CaCO_3$" – meaning the amount of hardness expressed as if calcium carbonate was the sole source of hardness. Every bicarbonate ion only counts for half as much carbonate hardness as a carbonate ion does. If a solution contained 1 liter of water and 50 mg $NaHCO_3$ (baking soda), it would have a carbonate hardness of about 18 mg/L as $CaCO_3$. If you had a liter of water containing 50 mg of Na_2CO_3, it would have a carbonate hardness of about 29 mg/L as $CaCO_3$. Carbonate hardness supplements non-carbonate (a.k.a. "permanent") hardness where hard ions are associated with anions such as Chloride that do not precipitate out of solution when heated. Carbonate hardness is removed from water through the process of softening. Softening can be achieved by adding lime in the form of $Ca(OH)_2$, which reacts first with CO_2 to form calcium carbonate precipitate, reacts next with multi-valent cations to remove carbonate hardness, then reacts with anions to replace the non-carbonate hardness due to multi-valent cations with non-carbonate hardness due to calcium. The process requires recarbonation through the addition of carbon-dioxide to lower the pH which is raised during the initial softening process.
BREAK POINT CHLORINATION: The process of chlorinating the water with significant quantities of chlorine to oxidize all contaminants and organic wastes and leave all remaining chlorine as free chlorine.
BROMATE: An inorganic anion, bromate is tasteless and colorless, with a low volatility. As a moderately strong oxidant, bromate is reactive. BrO3- is a bromine-based oxoanion. A bromate is a chemical compound that contains this ion. Examples of bromates include sodium bromate, (NaBrO3), and potassium bromate, (KBrO3).
BROMINE: Chemical disinfectant (HALOGEN) that kills bacteria and algae. This chemical disinfectant has been used only on a very limited scale for water treatment because of its handling difficulties. This chemical causes skin burns on contact, and a residual is difficult to obtain.
BUFFER: Chemical that resists pH change, e.g. sodium bicarbonate
BULKING SLUDGE: A poor or slow settling activated sludge that results from the prevalence of filamentous organisms. A phenomenon that occurs in activated sludge plants whereby the sludge occupies excessive volumes and will not concentrate readily. This condition refers to a decrease in the ability of the sludge to settle and consequent loss over the settling tank weir. Bulking in activated sludge aeration tanks is caused mainly by excess suspended solids (SS) content. Sludge bulking in the final settling tank of an activated sludge plant may be caused by improper balance of the BOD load, SS concentration in the mixed liquor, or the amount of air used in aeration.
C
Ca: The chemical symbol for calcium.
CADMIUM: A chemical element with the symbol Cd and atomic number 48. A relatively abundant, soft, bluish-white, transition metal, cadmium is known to cause cancer and occurs with zinc ores. Cadmium is used largely in batteries and pigments, for example in plastic products.
CAKE: Dewatered sludge material with a satisfactory solids concentration to allow handling as a solid material.
CALCIUM HARDNESS: A measure of the calcium salts dissolved in water.

CALCIUM ION: Is divalent because it has a valence of +2.
CALCIUM, MAGNESIUM AND IRON: The three elements that cause hardness in water.
$CaOCl_2.4H_2O$: The molecular formula of Calcium hypochlorite.
CARBON DIOXIDE GAS: The pH will decrease and alkalinity will change as measured by the Langelier index after pumping carbon dioxide gas into water.
CARBONATE HARDNESS: Carbonate hardness is the measure of Calcium and Magnesium and other hard ions associated with carbonate ($CO_3$2-) and bicarbonate (HCO_3-) ions contained in a solution, usually water. It is usually expressed either as parts per million (ppm or mg/L), or in degrees (KH - from the German "Karbonathärte"). One German degree of carbonate hardness is equivalent to about 17.8575 mg/L.
CARBONATE, BICARBONATE AND HYDROXIDE: Chemicals that are responsible for the alkalinity of water.
CATHODIC PROTECTION: An operator should protect against corrosion of the anode and/or the cathode by painting the copper cathode. Cathodic protection interrupts corrosion by supplying an electrical current to overcome the corrosion-producing mechanism. Guards against stray current corrosion.
CAUSTIC SODA: Also known as sodium hydroxide and is used to raise pH.
CAUSTIC: NaOH (also called Sodium Hydroxide) is a strong chemical used in the treatment process to neutralize acidity, increase alkalinity or raise the pH value.
CENTRATE: The liquid remaining after solids have been removed in a centrifuge.
CENTRIFUGAL FORCE: That force when a ball is whirled on a string that pulls the ball outward. On a centrifugal pump, that force throws water from a spinning impeller.
CENTRIFUGAL PUMP: A pump consisting of an impeller fixed on a rotating shaft and enclosed in a casing, having an inlet and a discharge connection. The rotating impeller creates pressure in the liquid by the velocity derived from centrifugal force.
CENTRIFUGE: A dewatering device relying on centrifugal force to separate particles of varying density such as water and solids.
CHAIN OF CUSTODY (COC): A record of each person involved in the possession of a sample from the person who collects the sample to the person who analyzes the sample in the laboratory.
CHECK VALVE: Allows water to flow in only one direction.
CHELATION: A chemical process used to control scale formation in which a chelating agent "captures" scale-causing ions and holds them in solution.
CHEMICAL FEED RATE: Chemicals are added to the water in order to improve the subsequent treatment processes. These may include pH adjusters and coagulants. Coagulants are chemicals, such as alum, that neutralize positive or negative charges on small particles, allowing them to stick together and form larger particles that are more easily removed by sedimentation (settling) or filtration. A variety of devices, such as baffles, static mixers, impellers and in-line sprays, can be used to mix the water and distribute the chemicals evenly.
CHEMICAL OXIDIZER: KMnO4 is used for taste and odor control because it is a strong oxidizer that eliminates many organic compounds.
CHEMICAL OXYGEN DEMAND (COD): The milligrams of oxygen required to chemically oxidize the organic contaminants in one liter of wastewater.
CHEMICAL REACTION RATE: In general, when the temperature decreases, the chemical reaction rate also decreases. The opposite is true for when the temperature increases.
CHEMICAL SLUDGE: Sludge resulting from chemical treatment processes of inorganic wastes that are not biologically active.
CHLORAMINATION: Treating drinking water by applying chlorine before or after ammonia. This creates a persistent disinfectant residual called chloramines.
CHLORAMINES: A group of chlorine ammonia compounds formed when chlorine combines with organic wastes in the water. Chloramines are not effective as disinfectants and are responsible for eye and skin irritation as well as strong chlorine odors (also known as Combined Chlorine).
CHLORINATION: The process in water treatment of adding chlorine (gas or solid hypochlorite) for purposes of disinfection.
CHLORINE DEMAND: Amount of chlorine required to react on various water impurities before a residual is obtained. Also, means the amount of chlorine required to produce a free chlorine residual of 0.1 mg/l after a contact time of fifteen minutes as measured by Iodometric method of a sample at a temperature of twenty degrees in conformance with Standard methods.
CHLORINE FEED: Chlorine may be delivered by vacuum-controlled solution feed chlorinators. The chlorine gas is controlled, metered, introduced into a stream of injector water and then conducted as a solution to the point of application.
CHLORINE, FREE: Chlorine available to kill bacteria or algae. The amount of chlorine available for sanitization after the chlorine demand has been met. Also known as chlorine residual.
CHLORINE: A chemical used to disinfect water. Chlorine is extremely reactive, and when it comes in contact with microorganisms in water it kills them. Chlorine is added to swimming pools to keep the water safe for swimming. Chlorine is available as solid tablets for swimming pools. Some public water system's drinking water treatment plants use chlorine in a gas form because of the large volumes required. Chlorine is very effective against algae, bacteria

and viruses. Protozoa are resistant to chlorine because they have thick coats; protozoa are removed from drinking water by filtration.
CHLORITE: The chlorite ion is ClO2−. A chlorite (compound) is a compound that contains this group, with chlorine in oxidation state +3. Chlorites are also known as salts of chlorous acid.
CHROMIUM: A chemical element which has the symbol Cr and atomic number 24. It is a steel-gray, lustrous, hard metal that takes a high polish and has a high melting point. It is also odorless, tasteless, and malleable.
CHRONIC: A stimulus that lingers or continues for a relatively long period of time, often one-tenth of the life span or more. Chronic should be considered a relative term depending on the life span of an organism. The measurement of chronic effect can be reduced growth, reduced reproduction, etc., in addition to lethality.
CIRCULATION: The continual flow of drilling fluid from injection to recovery and recirculation at the surface.
CLARIFIER: A settling tank used to remove suspended solids by gravity settling. Commonly referred to as sedimentation or settling basins, they are usually equipped with a motor driven chain and flight or rake mechanism to collect settled sludge and move it to a final removal point.
ClO_2: The molecular formula of Chlorine dioxide.
COAGULATION: The best pH range for coagulation is between 5 and 7. Mixing is an important part of the coagulation process you want to complete the coagulation process as quickly as possible. A chemical added to initially destabilize, aggregate, and bind together colloids and emulsions to improve settleability, filterability, or drainability.
COLIFORM TESTING: The effectiveness of disinfection is usually determined by Coliform bacteria testing. A positive sample is a bad thing and indicates that you have bacteria contamination.
COLIFORM: Bacteria normally found in the intestines of warm-blooded animals. Coliform bacteria are present in high numbers in animal feces. They are an indicator of potential contamination of water. Adequate and appropriate disinfection effectively destroys coliform bacteria. Public water systems are required to deliver safe and reliable drinking water to their customers 24 hours a day, 365 days a year. If the water supply becomes contaminated, consumers can become seriously ill. Fortunately, public water systems take many steps to ensure that the public has safe, reliable drinking water. One of the most important steps is to regularly test the water for coliform bacteria. Coliform bacteria are organisms that are present in the environment and in the feces of all warm-blooded animals and humans. Coliform bacteria will not likely cause illness. However, their presence in drinking water indicates that disease-causing organisms (pathogens) could be in the water system. Most pathogens that can contaminate water supplies come from the feces of humans or animals. Testing drinking water for all possible pathogens is complex, time-consuming, and expensive. It is relatively easy and inexpensive to test for coliform bacteria. If coliform bacteria are found in a water sample, water system operators work to find the source of contamination and restore safe drinking water. There are three different groups of coliform bacteria; each has a different level of risk.
COLLOIDAL SUSPENSIONS: Because both iron and manganese react with dissolved oxygen to form insoluble compounds, they are not found in high concentrations in waters containing dissolved oxygen except as colloidal suspensions of the oxide.
COLORIMETRIC MEASUREMENT: A means of measuring an unknown chemical concentration in water by measuring a sample's color intensity.
COMBINED CHLORINE: The reaction product of chlorine with ammonia or other pollutants, also known as chloramines.
COMBINED RADIUM 226/228: Some people who drink water containing radium 226 or 228 in excess of EPA standard over many years may have an increased risk of getting cancer.
COMPOSITE SAMPLE: A water sample that is a combination of a group of samples collected at various intervals during the day. A combination of individual samples of water or wastewater taken at predetermined intervals to minimize the effect of variability of individual samples. To have significant meaning, samples for laboratory tests on wastewater should be representative of the wastewater. The best method of sampling is proportional composite sampling over several hours during the day. Composite samples are collected because the flow and characteristics of the wastewater are continually changing. A composite sample will give a representative analysis of the wastewater conditions.
COMPOSTING: Stabilization process relying on the aerobic decomposition of organic matter in sludge by bacteria and fungi.
CONDENSATION: The process that changes water vapor to tiny droplets or ice crystals.
CONTACT STABILIZATION PROCESS: Modification of the activated sludge process where raw wastewater is aerated with activated sludge for a short time prior to solids removal and continued aeration in a stabilization tank.
CONTACT TIME (CT): To inactivate viruses and bacteria, the minimum disinfection contact time measured before the first customer should be six milligrams per minute per liter (6 mg-min/L). This value is called “Chlorine Contact Time” or CT. To calculate CT, multiply the free chlorine residual concentration (C) times the contact time (T). To get the required CT value of 6, adjust the free chlorine residual concentration or the contact time.
CONTACT TIME: If the water temperature decreases from 70°F (21°C) to 40°F (4°C). The operator needs to increase the detention time to maintain good disinfection of the water.
CONTAMINANT: Any natural or man-made physical, chemical, biological, or radiological substance or matter in water, which is at a level that may have an adverse effect on public health, and which is known or anticipated to occur in public water systems.

CONTAMINATION: A degradation in the quality of groundwater in result of the it's becoming polluted with unnatural or previously non-existent constituents.
COPPER: The chemical name for the symbol Cu.
CORROSION: The removal of metal from copper, other metal surfaces and concrete surfaces in a destructive manner. Corrosion is caused by improperly balanced water or excessive water velocity through piping or heat exchangers.
CORROSIVITY: The Langelier Index measures corrosivity.
CROSS-CONNECTION: A physical connection between a public water system and any source of water or other substance that may lead to contamination of the water provided by the public water system through backflow. Might be the source of an organic substance causing taste and odor problems in a water distribution system.
CROSS-CONTAMINATION: The mixing of two unlike qualities of water. For example, the mixing of good water with a polluting substance like a chemical.
CRYPTOSPORIDIUM: A disease-causing parasite, resistant to chlorine disinfection. It may be found in fecal matter or contaminated drinking water. Cryptosporidium is a protozoan pathogen of the Phylum Apicomplexa and causes a diarrheal illness called cryptosporidiosis. Other apicomplexan pathogens include the malaria parasite Plasmodium, and Toxoplasma, the causative agent of toxoplasmosis. Unlike Plasmodium, which transmits via a mosquito vector, Cryptosporidium does not utilize an insect vector and is capable of completing its life cycle within a single host, resulting in cyst stages that are excreted in feces and are capable of transmission to a new host.
CRYPTOSPORIDIUM: A parasite that enters lakes and rivers through sewage and animal waste. It causes cryptosporidiosis, a mild gastrointestinal disease. However, the disease can be severe or fatal for people with severely weakened immune systems. The EPA and the CDC have prepared advice for those with severely compromised immune systems who are concerned about Cryptosporidium.
CYANOBACTERIA: Cyanobacteria, also known as blue-green algae, blue-green bacteria or Cyanophyta, is a phylum of bacteria that obtain their energy through photosynthesis. The name "cyanobacteria" comes from the color of the bacteria (Greek: kyanós = blue). They are a significant component of the marine nitrogen cycle and an important primary producer in many areas of the ocean, but are also found on land.
CYANURIC ACID: Chemical used to prevent the decomposition of chlorine by ultraviolet (UV) light.
CYST: A phase or a form of an organism produced either in response to environmental conditions or as a normal part of the life cycle of the organism. It is characterized by a thick and environmentally resistant cell wall.

D

DAILY MAXIMUM LIMITATIONS: The maximum allowable discharge of pollutants during a 24 hour period. Where daily maximum limitations are expressed in units of mass, the daily discharge is the total mass discharged over the course of the day. Where daily maximum limitations are expressed in terms of a concentration, the daily discharge is the arithmetic average measurement of the pollutant concentration derived from all measurements taken that day.
DANGEROUS CHEMICALS: The most suitable protection when working with a chemical that produces dangerous fumes is to work under an air hood.
DECANT: Separation of a liquid from settled solids by removing the upper layer of liquid after the solids have settled.
DECOMPOSE: To decay or rot.
DECOMPOSITION OF ORGANIC MATERIAL: The decomposition of organic material in water produces taste and odors.
DEMINERALIZATION PROCESS: Mineral concentration of the feed water is the most important consideration in the selection of a demineralization process. Acid feed is the most common method of scale control in a membrane demineralization treatment system.
DENITRIFICATION: A biological process by which nitrate is converted to nitrogen gas.
DEPOLARIZATION: The removal of hydrogen from a cathode.
DESICCANT: When shutting down equipment that may be damaged by moisture, the unit may be protected by sealing it in a tight container. This container should contain a desiccant.
DESORPTION: Desorption is a phenomenon whereby a substance is released from or through a surface. The process is the opposite of sorption (that is, adsorption and absorption). This occurs in a system being in the state of sorption equilibrium between bulk phase (fluid, i.e. gas or liquid solution) and an adsorbing surface (solid or boundary separating two fluids). When the concentration (or pressure) of substance in the bulk phase is lowered, some of the sorbed substance changes to the bulk state. In chemistry, especially chromatography, desorption is the ability for a chemical to move with the mobile phase. The more a chemical desorbs, the less likely it will adsorb, thus instead of sticking to the stationary phase, the chemical moves up with the solvent front. In chemical separation processes, stripping is also referred to as desorption as one component of a liquid stream moves by mass transfer into a vapor phase through the liquid-vapor interface.
DIATOMACEOUS EARTH: A fine silica material containing the skeletal remains of algae.
DIGESTER: A tank or vessel used for sludge digestion.
DIGESTION: The biological decomposition of organic matter in sludge resulting in partial gasification, liquefaction, and mineralization of putrescible and offensive solids.

DIRECT CURRENT: A source of direct current (**DC**) may be used for standby lighting in a water treatment facility. The electrical current used in a DC system may come from a battery.
DISINFECT: The application of a chemical to kill most, but not all, microorganisms that may be present. Chlorine is added to public water drinking systems drinking water for disinfection. Depending on your state rule, drinking water must contain a minimum of 0.2 mg/L free chlorine. Disinfection makes drinking water safe to consume from the standpoint of killing pathogenic microorganisms including bacteria and viruses. Disinfection does not remove all bacteria from drinking water, but the bacteria that can survive disinfection with chlorine are not pathogenic bacteria that can cause disease in normal healthy humans.
DISINFECTION BYPRODUCTS: Disinfection byproducts are chemical, organic and inorganic substances that can form during a reaction of a disinfectant with naturally present organic matter in the water.
DISINFECTION: The treatment of water to inactivate, destroy, and/or remove pathogenic bacteria, viruses, protozoa, and other parasites.
DISSOLVED OXYGEN: Can be added to zones within a lake or reservoir that would normally become anaerobic during periods of thermal stratification.
DISSOLVED SOLIDS: Solids in solution that cannot be removed by filtration with a 0.45 micron filter.
DISTILLATION, REVERSE OSMOSIS AND FREEZING: Processes that can be used to remove minerals from the water.
DPD METHOD: Presence of free chlorine in the distribution network is indication of correct disinfection. Chlorine in water is determined according to ISO 7393-2 by colorimetric HACH method on the basis of DPD (N, N-diethyl - p – phenylendiamine). The photometric detection uses the wave lengths of 490 – 555 nm. Hach elected, for most of his DPD colorimetric systems, the wavelength of 530 nm.
DRY ACID: A granular chemical used to lower pH and or total alkalinity.

E

E. COLI, Escherichia coli: A bacterium commonly found in the human intestine. For water quality analyses purposes, it is considered an indicator organism. These are considered evidence of water contamination. Indicator organisms may be accompanied by pathogens, but do not necessarily cause disease themselves.
ECOLOGY: The study of how organisms interact with their environments.
ECOSYSTEM: The sum of physical features and organisms occurring in a given area.
ECTODERM: The outermost tissue layer of an animal embryo. Also, tissue derived from an embryonic ectoderm.
EFFECTIVENESS OF CHLORINE: The factors which influence the effectiveness of chlorination the most are pH, turbidity and temperature. Effectiveness of Chlorine decreases occurs during disinfection in source water with excessive turbidity.
EFFECTOR: The part of an organism that produces a response to a stimulus.
EFFLUENT: Partially or completely treated water or wastewater flowing out of a basin or treatment plant.
ELECTRON MICROSCOPE: A microscope that focuses an electron beam through a specimen, resulting in resolving power a thousandfold greater than that of a light microscope. A transmission EM is used to study the internal structure of thin sections of cells; a scanning EM is used to study the ultrastructure of surfaces.
ELECTRON TRANSPORT CHAIN: A series of enzymes found in the inner membranes of mitochondria and chloroplasts. These are involved in transport of protons and electrons either across the membrane during ATP synthesis.
ELECTRON: The name of a negatively charged atomic particle. A negatively charged subatomic particle of an atom or ion. In atoms, the number of electrons present is equal to the number of positively charged protons present. Hence, atoms are electrically neutral.
ELECTRONEGATIVITY: A property exhibited by some atoms whereby the nucleus has a tendency to pull electrons toward itself.
ELECTRONIC CHARGE UNIT: The charge of one electron (1.6021 x 10e - 19 coulomb).
ELECTROSTATIC FORCE: The attraction between particles with opposite charges.
ELECTROSTATIC GRADIENT: The free-energy gradient created by a difference in charge between two points, generally the two sides of a membrane.
ELEMENT: Any substance that cannot be broken down into another substance by ordinary chemical means.
ELIMINATION: The release of unabsorbed wastes from the digestive tract.
EMULSION: A suspension, usually as fine droplets of one liquid in another. A mixture made up of dissimilar elements, usually of two or more mutually insoluble liquids that would normally separate into layers based on the specific gravity of each liquid.
ENDERGONIC: A phenomenon that involves uptake of energy.
ENDOCRINE: A phenomenon that relates to the presence of ductless glands of the type typically found in vertebrates. The endocrine system involves hormones, the glands that secrete them, the molecular hormone receptors of target cells, and interactions between hormones and the nervous system.
ENDONUCLEASE: An enzyme that breaks bonds within nucleic acids. A restriction endonuclease is an enzyme that breaks bonds only within a specific sequence of bases.

ENDOPLASMIC RETICULUM: A system of membrane-bounded tubes and flattened sacs, often continuous with the nuclear envelope, found in the cytoplasm of eukaryotes. Exists as rough ER, studded with ribosomes, and smooth ER, lacking ribosomes.
ENDORPHIN: A hormone produced in the brain and anterior pituitary that inhibits pain perception.
ENDOSKELETON: An internal skeleton.
ENDOSPERM: A nutritive material in plant seeds which is triploid (3n) and results from the fusion of three nuclei during double fertilization.
ENDOSYMBIOTIC: 1) An association in which the symbiont lives within the host 2) A widely accepted hypothesis concerning the evolution of the eukaryotic cell: the idea that eukaryotes evolved as a result of symbiotic associations between prokaryote cells. Aerobic symbionts ultimately evolved into mitochondria; photosynthetic symbionts became chloroplasts.
ENERGY: The capacity to do work by moving matter against an opposing force.
ENTAMOEBA HISTOLYTICA: Entamoeba histolytica, another water-borne pathogen, can cause diarrhea or a more serious invasive liver abscess. When in contact with human cells, these amoebae are cytotoxic. There is a rapid influx of calcium into the contacted cell, it quickly stops all membrane movement save for some surface blebbing. Internal organization is disrupted, organelles lyse, and the cell dies. The ameba may eat the dead cell or just absorb nutrients released from the cell.
ENTERIC: Rod-shaped, gram-negative, aerobic but can live in certain anaerobic conditions; produce nitrite from nitrate, acids from glucose; include Escherichia coli, Salmonella (over 1000 types), and Shigella.
ENTEROVIRUS: A virus whose presence may indicate contaminated water; a virus that may infect the gastrointestinal tract of humans.
ENTROPY: A type of energy that is not biologically useful to do work (in contrast to free energy).
ENVELOPE: 1) (nuclear) The surface, consisting of two layers of membrane, that encloses the nucleus of eukaryotic cells. 2) (virus) A structure which is present on the outside of some viruses (exterior to the capsid).
ENVIRONMENT: Water, air, and land, and the interrelationship that exists among and between water, air and land and all living things. The total living and nonliving aspects of an organism's internal and external surroundings.
ENZYME: A protein, on the surface of which are chemical groups so arranged as to make the enzyme a catalyst for a chemical reaction.
EPIDERMIS: The outermost portion of the skin or body wall of an animal.
EPISOME: Genetic element at times free in the cytoplasm, at other times integrated into a chromosome.
EPISTASIS: A phenomenon in which one gene alters the expression of another gene that is independently inherited.
EPITHELIUM: An animal tissue that forms the covering or lining of all free body surfaces, both external and internal.
EQUATION: A precise representation of the outcome of a chemical reaction, showing the reactants and products, as well as the proportions of each.
EQUILIBRIUM: In a reversible reaction, the point at which the rate of the forward reaction equals that of the reverse reaction. (constant) At equilibrium, the ratio of products to reactants. (potential) The membrane potential for a given ion at which the voltage exactly balances the chemical diffusion gradient for that ion.
ESSENTIAL: 1) An amino or fatty acid which is required in the diet of an animal because it cannot be synthesized. 2) A chemical element required for a plant to grow from a seed and complete the life cycle.
ESTIVATION: A physiological state characterized by slow metabolism and inactivity, which permits survival during long periods of elevated temperature and diminished water supplies.
EUBACTERIA: The lineage of prokaryotes that includes the cyanobacteria and all other contemporary bacteria except archaebacteria.
EUCHROMATIN: The more open, unraveled form of eukaryotic chromatin, which is available for transcription.
EUCOELOMATE: An animal whose body cavity is completely lined by mesoderm, the layers of which connect dorsally and ventrally to form mesenteries.
EUGLENA: Euglena are common protists, of the class Euglenoidea of the phylum Euglenophyta. Currently, over 1000 species of Euglena have been described. Marin et al. (2003) revised the genus so and including several species without chloroplasts, formerly classified as Astasia and Khawkinea. Euglena sometimes can be considered to have both plant and animal features. Euglena gracilis has a long hair-like thing that stretches from its body. You need a very powerful microscope to see it. This is called a flagellum, and the euglena uses it to swim. It also has a red eyespot. Euglena gracilis uses its eyespot to locate light. Without light, it cannot use its chloroplasts to make itself food.
EUKARYOTE: A life form comprised of one or more cells containing a nucleus and membrane - bound organelles. Included are members of the Kingdoms Protista, Fungi, Plantae and Animalia.
EUMETAZOA: Members of the subkingdom that includes all animals except sponges.
EUTROPHIC: A highly productive condition in aquatic environments which owes to excessive concentrations of nutrients which support the growth of primary producers.
EVAGINATED: Folded or protruding outward.
EVAPORATIVE COOLING: The property of a liquid whereby the surface becomes cooler during evaporation, owing to the loss of highly kinetic molecules to the gaseous state.

EVERSIBLE: Capable of being turned inside out.
EXCITABLE CELLS: A cell, such as a neuron or a muscle cell that can use changes in its membrane potential to conduct signals.
EXCRETION: Release of materials which arise in the body due to metabolism (e.g., CO_2, NH_3, H_20).
EXERGONIC: A phenomenon which involves the release of energy.
EXOCYTOSIS: A process by which a vesicle within a cell fuses with the plasma membrane and releases its contents to the outside.
EXON: A part of a primary transcript (and the corresponding part of a gene) that is ultimately either translated (in the case of mRNA) or utilized in a final product, such as tRNA.
EXOSKELETON: An external skeleton, characteristic of members of the phylum, Arthropoda.
EXOTHERMIC: A process or reaction that is accompanied by the creation of heat.
EXOTOXIN: A toxic protein secreted by a bacterial cell that produces specific symptoms even in the absence of the bacterium.
EXTRINSIC: External to, not a basic part of; as in extrinsic isolating mechanism.

F

F PLASMID: The fertility factor in bacteria, a plasmid that confers the ability to form pili for conjugation and associated functions required for transfer of DNA from donor to recipient.
F: The chemical symbol of Fluorine.
FACILITATED DIFFUSION: Passive movement through a membrane involving a specific carrier protein; does not proceed against a concentration gradient.
FACULTATIVE: An organism which exhibits the capability of changing from one habit or metabolic pathway to another, when conditions warrant. (anaerobe) An organism that makes ATP by aerobic respiration if oxygen is present but that switches to fermentation under anaerobic conditions.
FAT: A biological compound consisting of three fatty acids linked to one glycerol molecule.
FATTY ACID: A long carbon chain carboxylic acid. Fatty acids vary in length and in the number and location of double bonds; three fatty acids linked to a glycerol molecule form fat.
FAUNA: The animals of a given area or period.
FECAL COLIFORM: A group of bacteria that may indicate the presence of human or animal fecal matter in water. Total coliform, fecal coliform, and E. coli are all indicators of drinking water quality. The total coliform group is a large collection of different kinds of bacteria. Fecal coliforms are types of total coliform that mostly exist in feces. E. coli is a sub-group of fecal coliform. When a water sample is sent to a lab, it is tested for total coliform. If total coliform is present, the sample will also be tested for either fecal coliform or E. coli, depending on the lab testing method.
FECAL COLIFORM: Fecal Coliform and E. coli are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Microbes in these wastes can cause short-term effects, such as diarrhea, cramps, nausea, headaches, or other symptoms.
FECES: Indigestible wastes discharged from the digestive tract.
FEEDBACK: The process by which a control mechanism is regulated through the very effects it brings about. Positive feedback is when the effect is amplified; negative feedback is when the effect tends toward restoration of the original condition. Feedback inhibition is a method of metabolic control in which the end-product of a metabolic pathway acts as an inhibitor of an enzyme within that pathway.
FERMENTATION: Anaerobic production of alcohol, lactic acid or similar compounds from carbohydrate resulting from glycolysis.
FERRIC CHLORIDE: An iron salt commonly used as a coagulant. Chemical formula is FeCl3.
FILTER AID: A polymer or other material added to improve the effectiveness of the filtration process.
FILTER CAKE: The layer of solids that is retained on the surface of a filter.
FILTER CLOGGING: An inability to meet demand may occur when filters are clogging.
FILTER PRESS: A dewatering device where sludge is pumped onto a filtering medium and water is forced out of the sludge, resulting in a “cake”.
FILTER: A device utilizing a granular material, woven cloth or other medium to remove pollutants from water, wastewater or air.
FILTRATE: Liquid remaining after removal of solids with filtration.
FILTRATION RATE: A measurement of the volume of water applied to a filter per unit of surface area in a given period of time.
FITNESS: The extent to which an individual passes on its genes to the next generation. Relative fitness is the number of offspring of an individual compared to the mean.
FIXATION: 1) Conversion of a substance into a biologically more usable form, for example, CO_2 fixation during photosynthesis and N_2 fixation. 2) Process of treating living tissue for microscopic examination.
FIXED ACTION PATTERN (FAP): A highly: stereotyped behavior that is innate and must be carried to completion once initiated.
FLACCID: Limp; walled cells are flaccid in isotonic surroundings, where there is no tendency for water to enter.
FLAGELLIN: The protein from which prokaryotic flagella are constructed.

FLAGELLUM: A long whip-like appendage that propels cells during locomotion in liquid solutions. The prokaryote flagellum is comprised of a protein, flagellin. The eukaryote flagellum is longer than a cilium, but as a similar internal structure of microtubules in a"9 + 2" arrangement.
FLAME CELL: A flagellated cell associated with the simplest tubular excretory system, present in flatworms: it acts to directly regulate the contents of the extracellular fluid.
FLOC SHEARING: Likely to happen to large floc particles when they reach the flocculation process.
FLOCCULANTS: Flocculants, or flocculating agents, are chemicals that promote flocculation by causing colloids and other suspended particles in liquids to aggregate, forming a floc. Flocculants are used in water treatment processes to improve the sedimentation or filterability of small particles. For example, a flocculant may be used in swimming pool or drinking water filtration to aid removal of microscopic particles which would otherwise cause the water to be cloudy and which would be difficult or impossible to remove by filtration alone. Many flocculants are multivalent cations such as aluminum, iron, calcium or magnesium. These positively charged molecules interact with negatively charged particles and molecules to reduce the barriers to aggregation. In addition, many of these chemicals, under appropriate pH and other conditions such as temperature and salinity, react with water to form insoluble hydroxides which, upon precipitating, link together to form long chains or meshes, physically trapping small particles into the larger floc. Long-chain polymer flocculants, such as modified polyacrylamides, are manufactured and sold by the flocculant producing business. These can be supplied in dry or liquid form for use in the flocculation process. The most common liquid polyacrylamide is supplied as an emulsion with 10-40 % actives and the rest is a carrier fluid, surfactants and latex. Emulsion polymers require activation to invert the emulsion and allow the electrolyte groups to be exposed.
FLOCCULATION BASIN: A compartmentalized basin with a reduction of speed in each compartment. This set-up or basin will give the best overall results.
FLOCCULATION: The process of bringing together destabilized or coagulated particles to form larger masses that can be settled and/or filtered out of the water being treated. Conventional coagulation–flocculation-sedimentation practices are essential pretreatments for many water purification systems—especially filtration treatments. These processes agglomerate suspended solids together into larger bodies so that physical filtration processes can more easily remove them. Particulate removal by these methods makes later filtering processes far more effective. The process is often followed by gravity separation (sedimentation or flotation) and is always followed by filtration. A chemical coagulant, such as iron salts, aluminum salts, or polymers, is added to source water to facilitate bonding among particulates. Coagulants work by creating a chemical reaction and eliminating the negative charges that cause particles to repel each other. The coagulant-source water mixture is then slowly stirred in a process known as flocculation. This water churning induces particles to collide and clump together into larger and more easily removable clots, or "flocs." The process requires chemical knowledge of source water characteristics to ensure that an effective coagulant mix is employed. Improper coagulants make these treatment methods ineffective. The ultimate effectiveness of coagulation/flocculation is also determined by the efficiency of the filtering process with which it is paired.
FLOOD RIM: The point of an object where the water would run over the edge of something and begin to cause a flood.
FLORA: The plants of a given area or period.
FLOW CYTOMETER: A particle-sorting instrument capable of counting protozoa.
FLUID FEEDER: An animal that lives by sucking nutrient-rich fluids from another living organism.
FLUID MOSAIC MODEL: The currently accepted model of cell membrane structure, which envisions the membrane as a mosaic of individually inserted protein molecules drifting laterally in a fluid bilayer of phospholipids.
FLUX: The term flux describes the rate of water flow through a semipermeable membrane. When the water flux decreases through a semipermeable membrane, it means that the mineral concentration of the water is increasing.
FLY ASH: The noncombustible particles in flue gas. Often used as a body feed or solidification chemical.
FOLLICLE STIMULATING HORMONE (FSH): A gonadotropic hormone of the anterior pituitary that stimulates growth of follicles in the ovaries of females and function of the seminiferous tubules in males.
FOLLICLE: A jacket of cells around an egg cell in an ovary.
FOOD CHAIN: Sequence of organisms, including producers, consumers, and decomposers, through which energy and materials may move in a community.
FOOD WEB: The elaborate, interconnected feeding relationships in an ecosystem.
FORMAZIN TURBIDITY UNIT (FTU): A unit used to measure the clarity of water. The ISO refers to the units as FNU (Formazin Nephelometric Units). The technique is the same as that for the NTU, but the calibration uses microspheres of the polymer formazin.
FORMULA: A precise representation of the structure of a molecule or ion, showing the proportion of atoms which comprise the material.
FOUNDER EFFECT: The difference between the gene pool of a population as a whole and that of a newly isolated population of the same species.
FRACTIONATION: An experimental technique that involves separation of parts of living tissue from one another using centrifugation.
FRAGMENTATION: A mechanism of asexual reproduction in which the parent plant or animal separates into parts that reform whole organisms.

FREE CHLORINE RESIDUAL: Regardless of whether pre-chloration is practiced or not, a free chlorine residual of at least 1.0 mg/L should be maintained in the clear well or distribution reservoir immediately downstream from the point of post-chlorination. The reason for chlorinating past the breakpoint is to provide protection in case of backflow.
FREE CHLORINE: In disinfection, chlorine is used in the form of free chlorine or as hypochlorite ion.
FREE OIL: Non-emulsified oil that separates from water, in a given period of time.
FREQUENCY DEPENDENT SELECTION: A decline in the reproductive success of a morph resulting from the morph's phenotype becoming too common in a population; a cause of balanced polymorphism in populations.
FUNCTIONAL GROUP: One of several groups of atoms commonly found in organic molecules. A functional group contributes somewhat predictable properties to the molecules that possess them.
FUNDAMENTAL NICHE: The total resources an organism is theoretically capable of utilizing.

G

G: (protein) A membrane protein that serves as an intermediary between hormone receptors and the enzyme adenylate cyclase, which converts ATP to cAMP in the second messenger system in non-steroid hormone action. Depending on the system, G proteins either increase or decrease cAMP production.
G1 PHASE: The first growth phase of the cell cycle, consisting of the portion of interphase before DNA synthesis is initiated.
G2 PHASE: The second growth phase of the cell cycle, consisting of the portion of interphase after DNA synthesis but before mitosis.
GAMETANGIUM: The reproductive organ of bryophytes, consisting of the male antheridium and female archegonium; a multi-chambered jacket of sterile cells in which gametes are formed.
GAMETE: A sexual reproductive cell that must usually fuse with another such cell before development begins; an egg or sperm.
GAMETOPHYTE: A haploid plant that can produce gametes.
GANGLION: A structure containing a group of cell bodies of neurons.
GAP JUNCTION: A narrow gap between plasma membranes of two animal cells, spanned by protein channels. They allow chemical substances or electrical signals to pass from cell to cell.
GASTRULATION: The process by which a blastula develops into a gastrula, usually by an involution of cells.
GATED ION CHANNEL: A membrane channel that can open or close in response to a signal, generally a change in the electrostatic gradient or the binding of a hormone, transmitter, or other molecular signal.
GEL ELECTROPHORESIS: In general, electrophoresis is a laboratory technique used to separate macromolecules on the basis of electric charge and size; the technique involves application of an electric field to a population of macromolecules which disperse according to their electric mobilities. In gel electrophoresis, the porous medium through which the macromolecules move is a gel.
GEL: Colloid in which the suspended particles form a relatively orderly arrangement.
GENE AMPLIFICATION: Any of the strategies that give rise to multiple copies of certain genes, thus facilitating the rapid synthesis of a product (such as rRna for ribosomes) for which the demand is great.
GENE CLONING: Formation by a bacterium, carrying foreign genes in a recombinant plasmid, of a clone of identical cells containing the replicated foreign genes.
GENE DELIVERY: This is a general term for the introduction of new genetic elements into the genomes of living cells. The delivery problem is essentially conditioned by the fact that the new genetic elements are usually large, and by the presence of the outer cell membrane and the nuclear membrane acting as barriers to incorporation of the new DNA into the genome already present in the nucleus. Viruses possess various natural biochemical methods for achieving gene delivery; artificial gene delivery is one of the essential problems of "genetic engineering". The most important barrier is apparently the outer cell membrane, which is essentially a lipid barrier, and introduction of any large complex into the cell requires a fusion of one kind or another with this membrane. Liposomes, which consist of lipid membranes themselves, and which can fuse with outer cell membranes, are thus potential vehicles for delivery of many substances, including DNA.
GENE FLOW: The movement of genes from one part of a population to another, or from one population to another, via gametes.
GENE POOL: The sum total of all the genes of all the individuals in a population.
GENE REGULATION: Any of the strategies by which the rate of expression of a gene can be regulated, as by controlling the rate of transcription.
GENE: The hereditary determinant of a specified characteristic of an individual; specific sequences of nucleotides in DNA.
GENETIC DRIFT: Change in the gene pool as a result of chance and not as a result of selection, mutation, or migration.
GENETIC RECOMBINATION: The general term for the production of offspring that combine traits of the two parents.
GENETICS: The science of heredity; the study of heritable information.
GENOME: The cell's total complement of DNA.
GENOMIC EQUIVALENCE: The presence of all of an organism's genes in all of its cells.
GENOMIC IMPRINTING: The parental effect on gene expression. Identical alleles may have different effects on offspring depending on whether they arrive in the zygote via the ovum or via the sperm.

GENOMIC LIBRARY: A set of thousands of DNA segments from a genome, each carried by a plasmid or phage.
GENOTYPE: The particular combination of genes present in the cells of an individual.
GENUS: A taxonomic category above the species level, designated by the first word of a species' binomial Latin name.
GIARDIA LAMBLIA: Giardia lamblia (synonymous with Lamblia intestinalis and Giardia duodenalis) is a flagellated protozoan parasite that colonizes and reproduces in the small intestine, causing giardiasis. The giardia parasite attaches to the epithelium by a ventral adhesive disc, and reproduces via binary fission. Giardiasis does not spread via the bloodstream, nor does it spread to other parts of the gastro-intestinal tract, but remains confined to the lumen of the small intestine. Giardia trophozoites absorb their nutrients from the lumen of the small intestine, and are anaerobes.
GIARDIA LAMBLIA*:* A parasite that enters lakes and rivers through sewage and animal waste. It causes gastrointestinal illness (e.g. diarrhea, vomiting, cramps).
GIS – GRAPHIC INFORMATION SYSTEM: Detailed information about the physical locations of structures such as pipes, valves, and manholes within geographic areas with the use of satellites.
GLIAL CELL: A non-conducting cell of the nervous system that provides support, insulation, and protection for the neurons.
GLIDING: Rod-shaped, gram-negative, mostly aerobic; glide on secreted slimy substances; form colonies, frequently with complex fruiting structures.
GLOMERULUS: A capillary bed within Bowman's capsule of the nephron; the site of ultrafiltration.
GLUCOSE: A six-carbon sugar which plays a central role in cellular metabolism.
GLYCOCALYX: The layer of protein and carbohydrates just outside the plasma membrane of an animal cell; in general, the proteins are anchored in the membrane, and the carbohydrates are bound to the proteins.
GLYCOGEN: A long, branched polymer of glucose subunits that is stored in the muscles and liver of animals and is metabolized as a source of energy.
GLYCOLYSIS: A metabolic pathway which occurs in the cytoplasm of cells and during which glucose is oxidized anaerobically to form pyruvic acid.
GLYCOPROTEIN: A protein with covalently linked sugar residues. The sugars may be bound to OH side chains of the polypeptide (O: linked) or the amide nitrogen of asparagine side chains (N: linked).
GLYCOSIDIC: A type of bond which links monosaccharide subunits together in di- or polysaccharides.
GLYOXYSOME: A type of microbody found in plants, in which stored lipids are converted to carbohydrates.
GOLGI APPARATUS: A system of concentrically folded membranes found in the cytoplasm of eukaryotic cells. Plays a role in the production and release of secretory materials such as the digestive enzymes manufactured in the pancreas.
GONADOTROPIN: Refers to a member of a group of hormones capable of promoting growth and function of the gonads. Includes hormones such as follicle stimulating hormone (FSH) and luteinizing hormone (LH) which are stimulatory to the gonads.
GOOD CONTACT TIME, pH and LOW TURBIDITY: These are factors that are important in providing good disinfection when using chlorine.
GPM: Gallons per minute.
GRAB SAMPLE: A sample that is taken from a water or wastestream on a one-time basis with no regard to the flow of the water or wastestream and without consideration of time. A single grab sample should be taken over a period of time not to exceed 15 minutes. A single water or wastewater sample taken at a time and place representative of total discharge.
GRADED POTENTIAL: A local voltage change in a neuron membrane induced by stimulation of a neuron, with strength proportional to the strength of the stimulus and lasting about a millisecond.
GRANUM: A stack-like grouping of photosynthetic membranes in a chloroplast
GRAVITY BELT THICKENER: A sludge dewatering device utilizing a filter belt to promote gravity drainage of water. Usually precedes additional dewatering treatment.
GRAVITY FILTER: A filter that operates at atmospheric pressure.
GRAVITY THICKENING: A sedimentation basin designed to operate at high solids loading rates.
GROWTH FACTOR: A protein that must be present in a cell's environment for its normal growth and development.
GT: Represents (Detention time) x (mixing intensity) in flocculation.
GYMNOSPERM: A vascular plant that bears naked seeds not enclosed in any specialized chambers.
H
H2SO4: The molecular formula of Sulfuric acid.
HABIT: In biology, the characteristic form or mode of growth of an organism.
HABITAT: The kind of place where a given organism normally lives.
HABITUATION: The process that results in a long-lasting decline in the receptiveness of interneurons to the input from sensory neurons or other interneurons (sensitization, adaptation).
HALIDES: A halide is a binary compound, of which one part is a halogen atom and the other part is an element or radical that is less electronegative than the halogen, to make a fluoride, chloride, bromide, iodide, or astatide compound. Many salts are halides. All Group 1 metals form halides with the halogens and they are white solids. A

halide ion is a halogen atom bearing a negative charge. The halide anions are fluoride (F), chloride (Cl), bromide (Br), iodide (I) and astatide (At). Such ions are present in all ionic halide salts.

HALOACETIC ACIDS: Haloacetic acids are carboxylic acids in which a halogen atom takes the place of a hydrogen atom in acetic acid. Thus, in a monohaloacetic acid, a single halogen would replace a hydrogen atom. For example, chloroacetic acid would have the structural formula CH_2ClCO_2H. In the same manner, in dichloroacetic acid two chlorine atoms would take the place of two hydrogen atoms ($CHCl_2CO_2H$).

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HAPLOID: The condition of having only one kind of a given type of chromosome.

HARD WATER: Hard water causes a buildup of scale in household hot water heaters. Hard water is a type of water that has high mineral content (in contrast with soft water). Hard water primarily consists of calcium (Ca2+), and magnesium (Mg2+) metal cations, and sometimes other dissolved compounds such as bicarbonates and sulfates. Calcium usually enters the water as either calcium carbonate ($CaCO_3$), in the form of limestone and chalk, or calcium sulfate ($CaSO_4$), in the form of other mineral deposits. The predominant source of magnesium is dolomite ($CaMg(CO_3)2$). Hard water is generally not harmful. The simplest way to determine the hardness of water is the lather/froth test: soap or toothpaste, when agitated, lathers easily in soft water but not in hard water. More exact measurements of hardness can be obtained through a wet titration. The total water 'hardness' (including both Ca2+ and Mg2+ ions) is read as parts per million or weight/volume (mg/L) of calcium carbonate (CaCO3) in the water. Although water hardness usually only measures the total concentrations of calcium and magnesium (the two most prevalent, divalent metal ions), iron, aluminum, and manganese may also be present at elevated levels in some geographical locations.

HARDNESS: A measure of the amount of calcium and magnesium salts in water. More calcium and magnesium lead to greater hardness. The term "hardness" comes from the fact that it is hard to get soapsuds from soap or detergents in hard water. This happens because calcium and magnesium react strongly with negatively charged chemicals like soap to form insoluble compounds.

HAZARDS OF POLYMERS: Slippery and difficult to clean-up are the most common hazards associated with the use of polymers in a water treatment plant.

HEAD: The measure of the pressure of water expressed in feet of height of water. 1 PSI = 2.31 feet of water or 1 foot of head equals about a half a pound of pressure or .433 PSI. There are various types of heads of water depending upon what is being measured. Static (water at rest) and Residual (water at flow conditions).

HEADWORKS: The facility at the "**head**" of the water source where water is first treated and routed into the distribution system.

HEALTH ADVISORY: An EPA document that provides guidance and information on contaminants that can affect human health and that may occur in drinking water, but which the EPA does not currently regulate in drinking water.

HEAT OF VAPORIZATION: The amount of energy absorbed by a substance when it changes state to a gas. Water absorbs approximately 580 calories per gram when it changes from liquid water-to-water vapor.

HEAT: The total amount of kinetic energy due to molecular motion in a body of matter. Heat is energy in its most random form.

HELPER T CELL: A type of T cell that is required by some B cells to help them make antibodies or that helps other T cells respond to antigens or secrete lymphokines or interleukins.

HEMAGGLUTININ: A surface antigen on influenza viruses that controls infectivity by associating with receptors on host erythrocytes or other cells.

HEMATOPOIETIC STEM CELLS: Cells found in the bone marrow of adult mammals which give rise to erythroid stem cells, lymphoid stem cells, and myeloid stem cells. Such cells give rise to erythrocytes and a variety of types of lymphocytes and leucocytes.

HEMOGLOBIN: An iron-containing respiratory pigment found in many organisms.

HEMOLYMPH: In invertebrates with open circulatory systems, the body fluid that bathes tissues.

HEMOPHILIA: A genetic disease resulting from an abnormal sex-linked recessive gene, characterized by excessive bleeding following injury.

HEPATIC: Pertaining to the liver.

HEREDITY: A biological phenomenon whereby characteristics are transmitted from one generation to another by virtue of chemicals (i.e. DNA) transferred during sexual or asexual reproduction.

HERPESVIRUS: A double stranded DNA virus with an enveloped, icosahedral capsid.

HERTZ: The term used to describe the frequency of cycles in an alternating current (AC) circuit. A unit of frequency equal to one cycle per second.

HETEROCHROMATIN: Non-transcribed eukaryotic chromatin that is so highly compacted that it is visible with a light microscope during interphase.

HETEROCHRONY: Evolutionary changes in the timing or rate of development.

HETEROCYST: A specialized cell that engages in nitrogen fixation on some filamentous cyanobacteria.

HETEROGAMY: The condition of producing gametes of two different types (contrast with isogamy).

HETEROMORPHIC: A condition in the life cycle of all modern plants in which the sporophyte and gametophyte generations differ in morphology.
HETEROSPOROUS: Referring to plants in which the sporophyte produces two kinds of spores that develop into unisexual gametophytes, either male or female.
HETEROTROPH: An organism dependent on external sources of organic compounds as a means of obtaining energy and/or materials. Such an organism requires carbon ("food") from its environment in an organic form. (synonym-organotroph).
HETEROTROPHIC PLATE COUNT: A test performed on drinking water to determine the total number of all types of bacteria in the water.
HETEROZYGOTE ADVANTAGE: A mechanism that preserves variation in eukaryotic gene pools by conferring greater reproductive success on heterozygotes over individuals homozygous for any one of the associated alleles.
HETEROZYGOUS: The condition whereby two different alleles of the gene are present within the same cell.
HF: The molecular formula of Hydrofluoric acid.
HIGH TURBIDITY CAUSING INCREASED CHLORINE DEMAND: May occur or be caused by the inadequate disinfection of water.
HIGH-TEST HYPOCHLORITE: A composition composed mainly of calcium hypochlorite is commonly called high test hypochlorite. High-Test Hypochlorite contains not less than 60.0% of available chlorine.
HISTAMINE: A substance released by injured cells that causes blood vessels to dilate during an inflammatory response.
HISTOLOGY: The study of tissues.
HISTONE: A type of protein characteristically associated with the chromosomes of eukaryotes.
HIV-1: Acute human immunodeficiency virus type 1 is the subtype of HIV (human immune deficiency virus) that causes most cases of AIDS in the Western Hemisphere, Europe, and Central, South, and East Africa. HIV is a retrovirus (subclass lentivirus), and retroviruses are single: stranded RNA viruses that have an enzyme called reverse transcriptase. With this enzyme the viral RNA is used as a template to produce viral DNA from cellular material. This DNA is then incorporated into the host cell's genome, where it codes for the synthesis of viral components. An HIV-1 infection should be distinguished from AIDS. Acquired immunodeficiency syndrome (AIDS) is a secondary immunodeficiency syndrome resulting from HIV infection and characterized by opportunistic infections, malignancies, neurologic dysfunction, and a variety of other syndromes.
HOLOBLASTIC: A type of cleavage in which there is complete division of the egg, as in eggs having little yolk (sea urchin) or a moderate amount of yolk (frog).
HOME RANGE: An area within which an animal tends to confine all or nearly all its activities for a long period of time.
HOMEOBOX: Specific sequences of DNA that regulate patterns of differentiation during development of an organism.
HOMEOSTASIS: A phenomenon whereby a state or process (for example, within an organism) is regulated automatically despite the tendency for fluctuations to occur.
HOMEOTHEMIC: Capable of regulation of constancy with respect to temperature.
HOMEOTIC GENES: Genes that control the overall body plan of animals by controlling the developmental fate of groups of cells.
HOMEOTIC: (mutation) A mutation in genes regulated by positional information that results in the abnormal substitution of one type of body part in place of another.
HOMOLOGOUS CHROMOSOMES: Chromosomes bearing genes for the same characters.
HOMOLOGOUS STRUCTURES: Characters in different species that were inherited from a common ancestor and thus share a similar ontogenetic pattern.
HOMOLOGY: Similarity in characteristics resulting from a shared ancestry.
HOMOPLASY: The presence in several species of a trait not present in their most common ancestor. Can result from convergent evolution, reverse evolution, or parallel evolution.
HOMOSPOROUS: Referring to plants in which a single type of spore develops into a bisexual gametophyte having both male and female sex organs.
HOMOZYGOUS: Having two copies of the same allele of a given gene.
HORMONE: A control chemical secreted in one part of the body that affects other parts of the body.
HOST RANGE: The limited number of host species, tissues, or cells that a parasite (including viruses and bacteria) can infect.
HUMORAL IMMUNITY: The type of immunity that fights bacteria and viruses in body fluids with antibodies that circulate in blood plasma and lymph, fluids formerly called humors.
HYBIRD VIGOR: Increased vitality (compared to that of either parent stock) in the hybrid offspring of two different, inbred parents.
HYBIRD: In evolutionary biology, a cross between two species. In genetics, a cross between two genetic types.
HYBIRDIZATION: The process whereby a hybrid results from interbreeding two species; 2) DNA hybridization is the comparison of whole genomes of two species by estimating the extent of hydrogen bonding that occurs between single-stranded DNA obtained from the two species.

HYBRIDOMA: A hybrid cell that produces monoclonal antibodies in culture, formed by the fusion of a myeloma cell with a normal antibody-producing lymphocyte.
HYDRATED LIME: The calcium hydroxide product that results from mixing quicklime with water. Chemical formula is CaOH2.
HYDRATION SHELL: A "covering" of water molecules which surrounds polar or charged substances in aqueous solutions. The association is due to the charged regions of the polar water molecules themselves.
HYDRIDES: Hydride is the name given to the negative ion of hydrogen, H. Although this ion does not exist except in extraordinary conditions, the term hydride is widely applied to describe compounds of hydrogen with other elements, particularly those of groups 1–16. The variety of compounds formed by hydrogen is vast, arguably greater than that of any other element. Various metal hydrides are currently being studied for use as a means of hydrogen storage in fuel cell-powered electric cars and batteries. They also have important uses in organic chemistry as powerful reducing agents, and many promising uses in hydrogen economy.
HYDROCARBON: Any compound made of only carbon and hydrogen.
HYDROCHLORIC ACID: It is the aqueous solution of hydrogen chloride gas (HCl). It is a strong acid, and the major component of gastric acid, and of wide industrial use. Hydrochloric acid must be handled with appropriate safety precautions because it is a highly corrosive liquid.
HYDROCHLORIC AND HYPOCHLOROUS ACIDS: The compounds that are formed in water when chlorine gas is introduced.
HYDROFLUOSILICIC ACID: (H_2SiF_6) a clear, fuming corrosive liquid with a pH ranging from 1 to 1.5. Used in water treatment to fluoridate drinking water.
HYDROGEN BOND: A type of bond formed when the partially positive hydrogen atom of a polar covalent bond in one molecule is attracted to the partially negative atom of a polar covalent bond in another.
HYDROGEN ION: A single proton with a charge of +1. The dissociation of a water molecule (H2O) leads to the generation of a hydroxide ion (OH-) and a hydrogen ion (H+).
HYDROGEN SULFIDE: A toxic gas formed by the anaerobic decomposition of organic matter. Chemical formula is H2S.
HYDROLYSIS: The chemical reaction that breaks a covalent bond through the addition of hydrogen (from a water molecule) to the atom forming one side of the original bond, and a hydroxyl group to the atom on the other side.
HYDROPHILIC: Having an affinity for water.
HYDROPHOBIC INTERACTION: A type of weak chemical bond formed when molecules that do not mix with water coalesce to exclude the water.
HYDROPHOBIC: The physicochemical property whereby a substance or region of a molecule resists association with water molecules.
HYDROSTATIC: Pertaining to the pressure and equilibrium of fluids. A hydrostatic skeleton is a skeletal system composed of fluid held under pressure in a closed body compartment; the main skeleton of most cnidarians, flatworms, nematodes, and annelids.
HYDROXYL GROUP: A functional group consisting of a hydrogen atom joined to an oxygen atom by a polar covalent bond. Molecules possessing this group are soluble in water and are called alcohols.
HYDROXYL ION: The OH- ion.
HYPEROSMOTIC: A solution with a greater solute concentration than another, a hypoosmotic solution. If the two solutions are separated from one another by a membrane permeable to water, water would tend to move from the hypo- to the hyperosmotic side.
HYPERPOLARIZATION: An electrical state whereby the inside of the cell is made more negative relative to the outside than was the case at resting potential. A neuron membrane is hyperpolarized if the voltage is increased from the resting potential of about -70 mV, reducing the chance that a nerve impulse will be transmitted.
HYPERTROPHY: Abnormal enlargement, excessive growth.
HYPHA: A fungal filament.
HYPOCHLORITE AND ORGANIC MATERIALS: Heat and possibly fire may occur when hypochlorite is brought into contact with an organic material.
HYPOCOTYL: The portion of the axis of a plant embryo below the point of attachment of the cotyledons; forms the base of the shoot and the root.
HYPOOSMOTIC SOLUTION: A solution with a lesser solute concentration than another, a hyperosmotic solution. If the two solutions are separated from one another by a membrane permeable to water, water would tend to move from the hypo- to the hyperosmotic side.
HYPOTHESIS: A formal statement of supposition offered to explain observations. Note that a hypothesis is only useful if it can be tested. Even if correct, it is not scientifically useful if untestable.
HYPOTHETICO-DEDUCTIVE: A method used to test hypotheses. If deductions formulated from the hypothesis are tested and proven false, the hypothesis is rejected.
If the actual pH of the water is below the calculated saturation pH, the LSI is negative and the water has a very limited scaling potential. If the actual pH exceeds pHs, the LSI is positive, and being supersaturated with CaCO3, the water has a tendency to form scale. At increasing positive index values, the scaling potential increases.

I

IMAGINAL DISK: An island of undifferentiated cells in an insect larva, which are committed (determined) to form a particular organ during metamorphosis to the adult.
IMBIBITION: The soaking of water into a porous material that is hydrophilic.
IMMUNE RESPONSE: 1) A primary immune response is the initial response to an antigen, which appears after a lag of a few days. 2) A secondary immune response is the response elicited when the animal encounters the same antigen at a later time. The secondary response is normally more rapid, of greater magnitude and of longer duration than the primary response.
IMMUNOGLOBULINE: The class of proteins comprising the antibodies.
IMMUNOLOGICAL: 1) Immunological distance is the amount of difference between two proteins as measured by the strength of the antigen: antibody reaction between them. 2) Immunological tolerance is a mechanism by which an animal does not mount an immune response to the antigenic determinants of its own macromolecules.
IMMUNOMAGNETIC SEPARATION (IMS): A purification procedure that uses microscopic, magnetically responsive particles coated with an antibodies targeted to react with a specific pathogen in a fluid stream. Pathogens are selectively removed from other debris using a magnetic field.
IMPELLERS: The semi-open or closed props or blades of a turbine pump that when rotated generate the pumping force.
IMPERVIOUS: Not allowing, or allowing only with great difficulty, the movement of water.
IMPRINTING: A type of learned behavior with a significant innate component, acquired during a limited critical period.
IN SERIES: Several components being connected one to the other without a bypass, requiring each component to work dependent on the one before it.
IN SITU: Treatment or disposal methods that do not require movement of contaminated material.
INCINERATION: The process of reducing the volume of a material by burning and reducing to ash if possible.
INCLINED PLATE SEPARATOR: A series of parallel inclined plates that can be used to increase the efficiency of clarifiers and gravity thickeners.
INCOMPLETE DOMINANCE: A type of inheritance in which F1 hybrids have an appearance that is intermediate between the phenotypes of the parental varieties.
INDETERMINATE: 1) A type of cleavage exhibited during the embryonic development in deuterostomes, in which each cell produced by early cleavage divisions retains the capacity to develop into a complete embryo; 2) A type of growth exhibited by plants: they continue to grow as long as they live, because they always retain meristematic cells capable of undergoing mitosis.
INDIRECT REUSE: The beneficial use of reclaimed water into natural surface waters or groundwater.
INDUCED FIT: The change in shape of the active site of an enzyme so that it binds more snugly to the substrate, induced by entry of the substrate.
INDUCTION: 1) The ability of one group of embryonic cells to influence the development of another. 2) A method in logic that proceeds from the specific to general and develops a general statement which explains all of the observations. Commonly used to formulate scientific hypotheses.
INDUSTRIAL WASTEWATER: Liquid wastes resulting from industrial processes.
INFECTIOUS PATHOGENS/MICROBES/GERMS: Are considered disease-producing bacteria, viruses and other microorganisms.
INFECTIOUS: 1) An infectious disease is a disease caused by an infectious microbial or parasitic agent. 2) Infectious hepatitis is the former name for hepatitis A. 3) Infectious mononucleosis is an acute disease that affects many systems, caused by the Epstein: Barr virus.
INFLAMMATORY RESPONSE: A line of defense triggered by penetration of the skin or mucous membranes, in which small blood vessels in the vicinity of an injury dilate and become leakier, enhancing infiltration of leukocytes; may also be widespread in the body.
INFLUENT: Water or wastewater flowing into a basin or treatment plant.
INFORMATION COLLECTION RULE (ICR): EPA collected data required by the Information Collection Rule (May 14, 1996) to support future regulation of microbial contaminants, disinfectants, and disinfection byproducts. The rule was intended to provide EPA with information on chemical byproducts that form when disinfectants used for microbial control react with chemicals already present in source water (disinfection byproducts (DBPs)); disease-causing microorganisms (pathogens), including Cryptosporidium; and engineering data to control these contaminants.
INGESTION: A heterotrophic mode of nutrition in which other organisms or detritus are eaten whole or in pieces.
INHIBITORY POSTSYNAPTIC POTENTIAL: An electrical charge (hyperpolarization) in the membrane of a postsynaptic neuron caused by the binding of an inhibitory neurotransmitter from a presynaptic cell to a postsynaptic receptor.
INITIAL PRECISION AND RECOVERY (IPR): Four aliquots of spiking suspension analyzed to establish the ability to generate acceptable precision and accuracy. An IPR is performed prior to the first time this method is used and any time the method or instrumentation is modified.
INNER CELL MASS: A cluster of cells in a mammalian blastocyst that protrudes into one end of the cavity and subsequently develops into the embryo proper and some of the extraembryonic membranes.

INORGANIC COMPOUND: Compounds that contain no carbon or contain only carbon bound to elements other than hydrogen.
INORGANIC CONTAMINANTS: Mineral-based compounds such as metals, nitrates, and asbestos. These contaminants are naturally occurring in some water, but can also get into water through farming, chemical manufacturing, and other human activities. EPA has set legal limits on 15 inorganic contaminants.
INORGANIC IONS: Present in all waters. Inorganic ions are essential for human health in small quantities, but in larger quantities they can cause unpleasant taste and odor or even illness. Most community water systems will commonly test for the concentrations of seven inorganic ions: nitrate, nitrite, fluoride, phosphate, sulfate, chloride, and bromide. Nitrate and nitrite can cause an illness in infants called methemoglobinemia. Fluoride is actually added to the drinking water in some public water systems to promote dental health. Phosphate, sulfate, chloride, and bromide have little direct effect on health, but high concentrations of inorganic ions can give water a salty or briny taste.
INSERTION: A mutation involving the addition of one or more nucleotide pairs to a gene.
INSOLUBLE COMPOUNDS: Are types of compounds cannot be dissolved. When iron or manganese reacts with dissolved oxygen (**DO**) insoluble compound are formed.
INSULIN: The vertebrate hormone that lowers blood sugar levels by promoting the uptake of glucose by most body cells and promoting the synthesis and storage of glycogen in the liver; also stimulates protein and fat synthesis; secreted by endocrine cells of the pancreas called islets of Langerhans.
INTAKE FACILITIES: One of the more important considerations in the construction of intake facilities is the ease of operation and maintenance over the expected lifetime of the facility. Every intake structure must be constructed with consideration for operator
INTEGRAL PROTEIN: A protein of biological membranes that penetrates into or spans the membrane.
INTERBREED: To breed with another kind or species; hybridize.
INTERFERON: A chemical messenger of the immune system, produced by virus: infected cells and capable of helping other cells resist the virus.
INTERLEUKIN: 1: A chemical regulator (cytokine) secreted by macrophages that have ingested a pathogen or foreign molecule and have bound with a helper T cell; stimulates T cells to grow and divide and elevates body temperature. Interleukin: 2, secreted by activated T cells, stimulates helper T cells to proliferate more rapidly.
INTERTIDAL ZONE: The shallow zone of the ocean where land meets water.
INTRON: The noncoding, intervening sequence of coding region (exon) in eukaryotic genes.
INVAGINATION: The buckling inward of a cell layer, caused by rearrangements of microfilaments and microtubules; an important phenomenon in embryonic development.
INVERSION: 1) An aberration in chromosome structure resulting from an error in meiosis or from mutagens; reattachment in a reverse orientation of a chromosomal fragment to the chromosome from which the fragment originated. 2) A phenomenon that occurs during early development of sponges at which time the external ciliated cells become inward-directed.
INVERTEBRATE: An animal without a backbone; invertebrates make up about 95% of animal species.
ION EXCHANGE: An effective treatment process used to remove iron and manganese in a water supply. The hardness of the source water affects the amount of water an ion exchange softener may treat before the bed requires regeneration.
ION: A charged chemical formed when an atom or group of atoms has more or less electrons than protons (rather than an equal number).
IONIC BOND: A chemical bond due to attraction between oppositely charged ions.
IRON AND MANGANESE: In water, they can usually be detected by observing the color of the inside walls of filters and the filter media. If the raw water is pre-chlorinated, there will be black stains on the walls below the water level and a black coating over the top portion of the sand filter bed. When significant levels of dissolved oxygen are present, iron and manganese exist in an oxidized state and normally precipitate into the reservoir bottom sediments. The presence of iron and manganese in water promote the growth of Iron bacteria. Only when a water sample has been acidified then you can perform the analysis beyond the 48-hour holding time. Iron and Manganese in water may be detected by observing the color of the of the filter media. Maintaining a free chlorine residual and regular flushing of water mains may control the growth of iron bacteria in a water distribution system.
IRON BACTERIA: In the management of water-supply wells, iron bacteria are bacteria that derive the energy they need to live and multiply by oxidizing dissolved ferrous iron (or the less frequently available manganese and aluminum). The resulting ferric oxide is insoluble, and appears as brown gelatinous slime that will stain plumbing fixtures, and clothing or utensils washed with the water carrying it, and may contribute to internal corrosion of the pipes and fixtures the water flows through. They are known to grow and proliferate in waters containing as low as 0.1mg/l of iron. However, at least 0.3 ppm of dissolved oxygen is needed to carry out oxidation. The proliferation of iron bacteria, in some way, increases the chance of sulfur bacteria infestation.
IRON: The elements iron and manganese are undesirable in water because they cause stains and promote the growth of iron bacteria.
ISOMER: Molecules consisting of the same numbers and kinds of atoms, but differing in the way in which the atoms are combined.

ISOSMOTIC: Solutions of equal concentration with respect to osmotic pressure.
ISOTOPE: An atomic form of an element, containing a different number of neutrons than another isotope. Isotopes vary from one another with respect to atomic mass.

K

K- SELECTION: The concept that life history of the population is centered upon producing relatively few offspring that have a good chance of survival.
KARYOGAMY: The fusion of nuclei of two cells, as part of syngamy.
KARYOTYPE: A method of classifying the chromosomes of a cell in relation to number, size and type.
KEYSTONE PREDATOR: A species that maintains species richness in a community through predation of the best competitors in the community, thereby maintaining populations of less competitive species.
KILL = C X T: Where other factors are constant, the disinfecting action may be represented by: Kill=C x T.
KILOCALORIE: A thousand calories; the amount of heat energy required to raise the temperature of 1 kilogram of water by primary C.
KINGDOM: A taxonomic category, the second broadest after domain.

L

L.O.T.O.: If a piece of equipment is locked out, the key to the lock-out device the key should be held by the person who is working on the equipment. The tag is an identification device and the lock is a physical restraint.
LABORATORY BLANK: See Method blank
LABORATORY CONTROL SAMPLE (LCS): See Ongoing precision and recovery (OPR) standard
LAND APPLICATION: The disposal of wastewater or municipal solids onto land under controlled conditions.
LAND DISPOSAL: Application of municipal wastewater solids to the soil without production of usable agricultural products.
LANDFILL: A land disposal site that employs an engineering method of solid waste disposal to minimize environmental hazards and protect the quality of surface and subsurface waters.
LANGELIER INDEX: A measurement of Corrosivity. The water is becoming corrosive in the distribution system causing rusty water if the Langelier index indicates that the pH has decreased from the equilibrium point. Mathematically derived factor obtained from the values of calcium hardness, total alkalinity, and pH at a given temperature. A Langelier index of zero indicates perfect water balance (i.e., neither corroding nor scaling). The Langelier Saturation Index (sometimes Langelier Stability Index) is a calculated number used to predict the calcium carbonate stability of water. It indicates whether the water will precipitate, dissolve, or be in equilibrium with calcium carbonate. Langelier developed a method for predicting the pH at which water is saturated in calcium carbonate (called pHs). The LSI is expressed as the difference between the actual system pH and the saturation pH.
LARVA (pl. larvae): A free-living, sexually immature form in some animal life cycles that may differ from the adult in morphology, nutrition, and habitat.
LEACHATE: Fluid that trickles through solid materials or wastes and contains suspended or dissolved materials or products of the solids.
LEACHING: A chemical reaction between water and metals that allows for removal of soluble materials.
LEADING STRAND: The new continuously complementary DNA strand synthesized along the template strand in the 5' --- > 3' direction.
LETHAL CONCENTRATION 50: Also referred to as LC50, a concentration of a pollutant or effluent at which 50 percent of the test organisms die; a common measure of acute toxicity.
LEUKOCYTE: A white blood cell; typically functions in immunity, such as phagocytosis or antibody production.
LEVELS OF ORGANIZATION: A basic concept in biology is that organization is based on a hierarchy of structural levels, with each level building on the levels below it.
LICHEN: An organism formed by the symbiotic association between a fungus and a photosynthetic alga.
LIFE: A table of data summarizing mortality in a population.
LIGAMENT: A type of fibrous connective tissue that joins bones together at joints.
LIGAND: A ligand is a molecule that binds specifically to a receptor site of another molecule. A ligase is an enzyme that catalyzes such a reaction. For example, a DNA ligase is an enzyme that catalyzes the covalent bonding of the 3' end of a new DNA fragment to the 5' end of a growing chain.
LIGASE: Ligases are enzymes that catalyze the "stitching together" of polymer fragments. DNA ligase, for example, catalyzes phosphodiester bond formation between two DNA fragments, and this enzyme is involved in normal DNA replication, repair of damaged chromosomes, and various in vitro techniques in genetic engineering that involve linking DNA fragments.
LIGNIN: A hard material embedded in the cellulose matrix of vascular plant cell walls that functions as an important adaptation for support in terrestrial species.
LIMBIC SYSTEM: A group of nuclei (clusters of nerve cell bodies) in the lower part of the mammalian forebrain that interact with the cerebral cortex in determining emotions; includes the hippocampus and the amygdala.
LIME SOFTENING: Lime softening is primarily used to “soften” water—that is to remove calcium and magnesium mineral salts. But it also removes harmful toxins like radon and arsenic. Though there is no consensus, some studies have even suggested that lime softening is effective at removal of Giardia. Hard water is a common condition responsible for numerous problems. Users often recognize hard water because it prevents their soap from lathering

properly. However, it can also cause buildup ("scale") in hot water heaters, boilers, and hot water pipes. Because of these inconveniences, many treatment facilities use lime softening to soften hard water for consumer use. Before lime softening can be used, managers must determine the softening chemistry required. This is a relatively easy task for groundwater sources, which remain more constant in their composition. Surface waters, however, fluctuate widely in quality and may require frequent changes to the softening chemical mix. In lime softening, lime and sometimes sodium carbonate are added to the water as it enters a combination solids contact clarifier. This raises the pH (i.e., increases alkalinity) and leads to the precipitation of calcium carbonate. Later, the pH of the effluent from the clarifier is reduced again, and the water is then filtered through a granular media filter. The water chemistry requirements of these systems require knowledgeable operators, which may make lime softening an economic challenge for some very small systems.

LIME STABILIZATION: The addition of lime to untreated sludge to raise the pH to 12 for a minimum of 2 hours to chemically inactivate microorganisms.

LIME: The term generally used to describe ground limestone (calcium carbonate), hydrated lime (calcium hydroxide), or burned lime (calcium oxide).

LINKED GENES: Genes that are located on the same chromosomes.

LIPID: One of a family of compounds, including fats, phospholipids, and steroids, that are insoluble in water.

LIPOSOME: Liposomes are vesicles (spherules) in which the lipid molecules are spontaneously arranged into bilayers with hydrophilic groups exposed to water molecules both outside the vesicle and in the core.

LISTED HAZARDOUS WASTE: The designation for a waste material that appears on an EPA list of specific hazardous wastes or hazardous waste categories.

LOCUS: A particular place along the length of a certain chromosome where a specified allele is located.

LOGISTIC POPULATION GROWTH: A model describing population growth that levels off as population size approaches carrying capacity.

LSI = pH - pHs

LYSOGENIC CYCLE: A type of viral replication cycle in which the viral genome becomes incorporated into the bacterial host chromosome as a prophage.

LYTIC CYCLE: A type of viral replication cycle resulting in the release of new phages by death or lysis of the host cell.

M

M PHASE: The mitotic phase of the cell cycle, which includes mitosis and cytokinesis.

M.S.D.S.: Now S.D.S. (Safety Data Sheet) .A safety document must an employer provide to an operator upon request.

MACROMOLECULE: A giant molecule of living matter formed by the joining of smaller molecules, usually by condensation synthesis. Polysaccharides, proteins, and nucleic acids are macromolecules.

MACROPHAGE: An amoeboid cell that moves through tissue fibers, engulfing bacteria and dead cells by phagocytosis.

MAGNESIUM HARDNESS: Measure of the magnesium salts dissolved in water – it is not a factor in water balance.

MAGNETIC STARTER: Is a type of motor starter should be used in an integrated circuit to control flow automatically.

MAJOR HISTOCOMPATIBILITY COMPLEX: A large set of cell surface antigens encoded by a family of genes. Foreign MHC markers trigger T-cell responses that may lead to rejection of transplanted tissues and organs.

MAKEUP WATER: Fluid introduced in a recirculating stream to maintain an equilibrium of temperature, solids concentration or other parameters. Also refers to the quantity of water required to make a solution.

MALPHIGHIAN TUBULE: A unique excretory organ of insects that empties into the digestive tract, removes nitrogenous wastes from the blood, and functions in osmoregulation.

MANGANESE (IV) OXIDE: The chemical compound MnO2, commonly called manganese dioxide. This blackish or brown solid occurs naturally as the mineral pyrolusite, which is the main ore of manganese. It is also present in manganese nodules. The principal use for MnO2 is for dry-cell batteries, such as the alkaline battery and the zinc-carbon battery. In 1976 this application accounted for 500,000 tons of pyrolusite. MnO2 is also used for production of MnO4–. It is used extensively as an oxidizing agent in organic synthesis, for example, for the oxidation of allylic alcohols.

MANTLE: A heavy fold of tissue in mollusks that drapes over the visceral mass and may secrete a shell.

MARBLE AND LANGELIER TESTS: Are used to measure or determine the corrosiveness of a water source.

MASS NUMBER: The sum of the number of protons plus the number of neutrons in the nucleus of an atom; unique for each element and designated by a superscript to the left of the elemental symbol.

MATRIX SPIKE (MS): A sample prepared by adding a known quantity of organisms to a specified amount of sample matrix for which an independent estimate of target analyte concentration is available. A matrix spike is used to determine the effect of the matrix on a method's recovery efficiency.

MATRIX: The nonliving component of connective tissue, consisting of a web of fibers embedded in homogeneous ground substance that may be liquid, jellylike, or solid.

MATTER: Anything that takes up space and has mass.

MAXIMUM CONTAMINANT LEVEL (MCL): The maximum concentration of a chemical that is allowed in public drinking water systems.

MAXIMUM CONTAMINANT LEVEL (MCLs): The maximum allowable level of a contaminant
MAXIMUM CONTAMINANT LEVEL GOAL (MCLG): The maximum level at which a contaminant can exist in drinking water without having an adverse effect on human health.
MECHANICAL SEAL: A mechanical device used to control leakage from the stuffing box of a pump. Usually made of two flat surfaces, one of which rotates on the shaft. The two flat surfaces are of such tolerances as to prevent the passage of water between them. Held in place with spring pressure.
MECHANORECEPTOR: A sensory receptor that detects physical deformations in the body environment associated with pressure, touch, stretch, motion, and sound.
MEDIAN BODIES: Prominent, dark-staining, paired organelles consisting of microtubules and found in the posterior half of *Giardia*. In *G. intestinalis* (from humans), these structures often have a claw-hammer shape, while in *G. muris* (from mice), the median bodies are round.
MEDIUM WATER SYSTEM: More than 3,300 persons and 50,000 or fewer persons.
MEDULLA OBLONGATA: The lowest part of the vertebrate brain; a swelling of the hindbrain dorsal to the anterior spinal cord that controls autonomic, homeostatic functions, including breathing, heart and blood vessel activity, swallowing, digestion, and vomiting.
MEDUSA: The floating, flattened, mouth-down version of the cnidarian body plan. The alternate form is the polyp.
MEGAPASCAL: A unit of pressure equivalent to 10 atmospheres of pressure.
MEGGER: Used to test the insulation resistance on a motor.
MEIOSIS: A two-stage type of cell division in sexually reproducing organisms that results in gametes with half the chromosome number of the original cell.
MEMBRANE POTENTIAL: The charge difference between the cytoplasm and extracellular fluid in all cells, due to the differential distribution of ions. Membrane potential affects the activity of excitable cells and the transmembrane movement of all charged substances.
MEMBRANE: A thin barrier that permits passage of particles of a certain size or of particular physical or chemical properties.
M-ENDO BROTH: The coliform group are used as indicators of fecal pollution in water, for assessing the effectiveness of water treatment and disinfection, and for monitoring water quality. m-Endo Broth is used for selectively isolating coliform bacteria from water and other specimens using the membrane filtration technique. m-Endo Broth is prepared according to the formula of Fifield and Schaufus.1 It is recommended by the American Public Health Association in standard total coliform membrane filtration procedure for testing water, wastewater, and foods.2,3 The US EPA specifies using m-Endo Broth in the total coliform methods for testing water using single-step, two-step, and delayed incubation membrane filtration methods.
MESENTERIES: Membranes that suspend many of the organs of vertebrates inside fluid- filled body cavities.
MESODERM: The middle primary germ layer of an early embryo that develops into the notochord, the lining of the coelom, muscles, skeleton, gonads, kidneys and most of the circulatory system.
MESOSOME: A localized infolding of the plasma membrane of a bacterium.
MESSENGER: (RNA) A type of RNA synthesized from DNA in the genetic material that attaches to ribosomes in the cytoplasm and specifies the primary structure of a protein.
METABOLISM: The sum total of the chemical and physical changes constantly taking place in living substances.
METALLOID: Metalloid is a term used in chemistry when classifying the chemical elements. On the basis of their general physical and chemical properties, nearly every element in the periodic table can be termed either a metal or a nonmetal. A few elements with intermediate properties are, however, referred to as metalloids. (In Greek metallon = metal and eidos = sort)
METAMORPHOSIS: The resurgence of development in an animal larva that transforms it into a sexually mature adult.
METANEPHRIDIUM: A type of excretory tubule in annelid worms that has internal openings called nephrostomes that collect body fluids and external openings called nephridiopores.
METASTASIS: The spread of cancer cells beyond their original site.
METAZOAN: A multicellular animal. Among important distinguishing characteristics of metazoa are cell differentiation and intercellular communication. For certain multicellular colonial entities such as sponges, some biologists prefer the term "parazoa".
METHANE: Methane is a chemical compound with the molecular formula CH_4. It is the simplest alkane, and the principal component of natural gas. Methane's bond angles are 109.5 degrees. Burning methane in the presence of oxygen produces carbon dioxide and water. The relative abundance of methane and its clean burning process makes it a very attractive fuel. However, because it is a gas at normal temperature and pressure, methane is difficult to transport from its source.
METHOD BLANK: An aliquot of reagent water that is treated exactly as a sample, including exposure to all glassware, equipment, solvents, and procedures that are used with samples. The method blank is used to determine if analytes or interferences are present in the laboratory environment, the reagents, or the apparatus.
Mg/L: Stands for "**milligrams per liter**." A common unit of chemical concentration. It expresses the mass of a chemical that is present in a given volume of water. A milligram (one one-thousandth of a gram) is equivalent to about 18 grains of table salt. A liter is equivalent to about one quart.

MICROBE OR MICROBIAL: Any minute, simple, single-celled form of life, especially one that causes disease.
MICROBIAL CONTAMINANTS: Microscopic organisms present in untreated water that can cause waterborne diseases.
MICROBIOLOGICAL: Is a type of analysis in which a composite sample unacceptable.
MICROBODY: A small organelle, bounded by a single membrane and possessing a granular interior. Peroxisomes and glyoxysomes are types of microbodies.
MICROFILAMENT: Minute fibrous structure generally composed of actin found in the cytoplasm of eukaryotic cells. They play a role in motion within cells.
MICROFILTRATION: A low-pressure membrane filtration process that removes suspended solids and colloids generally larger than 0.1 micron diameter.
MICROORGANISMS: Very small animals and plants that are too small to be seen by the naked eye and must be observed using a microscope. Microorganisms in water include algae, bacteria, viruses, and protozoa. Algae growing in surface waters can cause off-taste and odor by producing the chemicals MIB and geosmin. Certain types of bacteria, viruses, and protozoa can cause disease in humans. Bacteria are the most common microorganisms found in treated drinking water. The great majority of bacteria are not harmful. In fact, humans would not be able to live without the bacteria that inhabit the intestines. However, certain types of bacteria called coliform bacteria can signal the presence of possible drinking water contamination.
MICROSCOPE: An instrument that magnifies images either by using lenses in an optical system to bend light (light microscope) or electromagnets to direct the movement of electrons (electron microscope).
MICROTUBULE: A minute tubular structure found in centrioles, spindle apparati, cilia, flagella, and other places in the cytoplasm of eukaryotic cells. Microtubules play a role in movement and maintenance of shape.
MICROVILLUS: Collectively, fine, fingerlike projections of the epithelial cells in the lumen of the small intestine that increase its surface area.
MILLIGRAMS PER LITER: (mg/L) A common unit of measurement of the concentration of a material in solution.
MILLILITER: One one-thousandth of a liter; A liter is a little more than a quart. A milliliter is about two drops from an eyedropper.
MIMICRY: A phenomenon in which one species benefits by a superficial resemblance to an unrelated species. A predator or species of prey may gain a significant advantage through mimicry.
MISCIBLE: Capable of being mixed together.
MISSENSE: (mutation) The most common type of mutation involving a base- pair substitution within a gene that changes a codon, but the new codon makes sense, in that it still codes for an amino acid.
MITOCHONDRIAL MATRIX: The compartment of the mitochondrion enclosed by the inner membrane and containing enzymes and substrates for the Krebs cycle.
MITOCHONDRION: An organelle that occurs in eukaryotic cells and contains the enzymes of the citric acid cycle, the respiratory chain, and oxidative phosphorylation. A mitochondrion is bounded by a double membrane.
MITOSIS: A process of cell division in eukaryotic cells conventionally divided into the growth period (interphase) and four stages: prophase, metaphase, anaphase, and telophase. The stages conserve chromosome number by equally allocating replicated chromosomes to each of the daughter cells.
MIXED LIQUOR SUSPENDED SOLIDS: Suspended solids in the mixture of wastewater and activated sludge undergoing aeration in the aeration basin.
MODEM SYNTHESIS: A comprehensive theory of evolution emphasizing natural selection, gradualism, and populations as the fundamental units of evolutionary change; also called Neo-Darwinism.
MOISTURE AND POTASSIUM PERMANGANATE: The combination of moisture and potassium permanganate produces heat.
MOISTURE: If a material is hygroscopic, it must it be protected from water.
MOLARITY: A common measure of solute concentration, referring to the number of moles of solute in 1 L of solution.
MOLD: A rapidly growing, asexually reproducing fungus.
MOLE: The number of grams of a substance that equals its molecular weight in daltons and contains Avogadro's number of molecules.
MOLECULAR FORMULA: A type of molecular notation indicating only the quantity of the constituent atoms.
MOLECULAR WEIGHT: The molecular mass (abbreviated Mr) of a substance, formerly also called molecular weight and abbreviated as MW, is the mass of one molecule of that substance, relative to the unified atomic mass unit u (equal to 1/12 the mass of one atom of carbon-12). This is distinct from the relative molecular mass of a molecule, which is the ratio of the mass of that molecule to 1/12 of the mass of carbon 12 and is a dimensionless number. Relative molecular mass is abbreviated to Mr.
MOLECULE: Two or more atoms of one or more elements held together by ionic or covalent chemical bonds.
MOLTING: A process in arthropods in which the exoskeleton is shed at intervals to allow growth by secretion of a larger exoskeleton.
MONERA: The kingdom of life forms that includes all of the bacteria.
MONOMER: A small molecule, two or more of which can be combined to form oligomers (consisting of a few monomers) or polymers (consisting of many monomers).

MONOPHYLETIC: A term used to describe any taxon derived from a single ancestral form that gave rise to no species in other taxa.
MONOSACCHARIDE: A simple sugar; a monomer.
MORPHOGENESIS: The development of body shape and organization during ontogeny.
MORPHOSPECIES: Species defined by their anatomical features.
MOSAIC: A pattern of development, such as that of a mollusk, in which the early blastomeres each give rise to a specific part of the embryo. In some animals, the fate of the blastomeres is established in the zygote.
MOTOR NERVOUS SYSTEM: In vertebrates, the component of the peripheral nervous system that transmits signals from the central nervous system to effector cells.
MPF: M: phase promoting factor: A protein complex required for a cell to progress from late interphase to mitosis; the active form consists of cyclin and cdc2, a protein kinase.
MUD BALLS IN FILTER MEDIA: Is a possible result of an ineffective or inadequate filter backwash.
MULLERIAN MIMICRY: A mutual mimicry by two unpalatable species.
MULTIGENE FAMILY: A collection of genes with similar or identical sequences, presumably of common origin.
MUNICIPAL WASTE: The combined solid and liquid waste from residential, commercial and industrial sources.
MUNICIPAL WASTEWATER TREATMENT PLANT (MWTP): Treatment works designed to treat municipal wastewater.
MURIATIC ACID: An acid used to reduce pH and alkalinity. Also used to remove stain and scale.
MUST: This action, activity, or procedural step is required.
MUTAGEN: A chemical or physical agent that interacts with DNA and causes a mutation.
MUTAGENESIS: The creation of mutations.
MUTATION: A spontaneous or induced change in a gene's or chromosome's structure or number. The resulting individual is termed a mutant.
MUTUALISM: A symbiotic relationship in which both the host and the symbiont benefit.
MYCELIUM: The densely branched network of hyphae in a fungus.
MYCOBACTERIUM: Pleomorphic spherical or rod-shaped, frequently branching, no gram stain, aerobic; commonly form yellow pigments; include Mycobacterium tuberculosis, cause of tuberculosis.
MYCOPLASMA: Spherical, commonly forming branching chains, no gram stain, aerobic but can live in certain anaerobic conditions; without cell walls yet structurally resistant to lysis; among smallest of bacteria; named for superficial resemblance to fungal hyphae (myco-means "fungus').
MYELIN SHEATH: An insulating coat of cell membrane from Schwann cells that is interrupted by nodes of Ranvier where saltatory conduction occurs.
MYOFIBRILS: Fibrils arranged in longitudinal bundles in muscle cells (fibers); composed of thin filaments of actin and a regulatory protein and thick filaments of myosin.
MYOGLOBIN: An oxygen-storing, pigmented protein in muscle cells.
MYOSIN: A type of protein filament that interacts with actin filaments to cause cell movement, such as contraction in muscle cells.

N

NAD+: Nicatinamide adenine dinucleotide (oxidized); a coenzyme present in all cells that assists enzymes in transferring electrons during the redox reactions of metabolism.
NANO-FILTRATION: A specialty membrane filtration process that rejects solutes larger than approximately one nanometer (10 angstroms) in size.
NANOMETER: A unit of measure (length). 1 nm is equal to 1 x 10: 9 m, or 1/1,000,000 mm.
NaOCl: Is the molecular formula of Sodium hypochlorite.
NaOH: Is the molecular formula of Sodium hydroxide.
NATURAL ORGANIC MATTER: Organic matter present in natural waters.
NEGATIVE CONTROL: See Method blank.
NEGATIVE FEEDBACK: A primary mechanism of homeostasis, whereby a change in a physiological variable that is being monitored triggers a response that counteracts the initial fluctuation.
NEPHELOMETRIC TURBIDITY UNIT (NTU): The unit used to describe turbidity. Nephelometric refers to the way the instrument, a nephelometer, measures how much light is scattered by suspended particles in the water. The greater the scattering, the higher the turbidity. Therefore, low NTU values indicate high water clarity, while high NTU values indicate low water clarity.
NEURON: A nerve cell; the fundamental unit of the nervous system, having structure and properties that allow it to conduct signals by taking advantage of the electrical charge across its cell membrane.
NEUROSECRETORY CELLS: Cells that receive signals from other nerve cells, but instead of signaling to an adjacent nerve cell or muscle, release hormones into the blood stream.
NEUROTRANSMITTER: The chemical messenger released from the synaptic terminals of a neuron at a chemical synapse that diffuses across the synaptic cleft and binds to and stimulates the postsynaptic cell.
NEUTRAL VARIATION: Genetic diversity that confers no apparent selective advantage.
NEUTRALIZATION REACTIONS: Chemical reactions between acids and bases where water is an end product.

NEUTRALIZATION: The chemical process that produces a solution that is neither acidic nor alkaline. Usually with a pH between 6 and 8.
NEUTRON: An uncharged subatomic particle of about the same size and mass as a proton.
NH3: The molecular formula of Ammonia.
NH4+: The molecular formula of the Ammonium ion.
NITRATES: A dissolved form of nitrogen found in fertilizers and sewage by-products that may leach into groundwater and other water sources. Nitrates may also occur naturally in some waters. Over time, nitrates can accumulate in aquifers and contaminate groundwater.
NITROGEN AND PHOSPHORUS: Pairs of elements and major plant nutrients that cause algae to grow.
NITROGEN: Nitrogen is a nonmetal, with an electronegativity of 3.0. It has five electrons in its outer shell and is therefore trivalent in most compounds. The triple bond in molecular nitrogen (N2) is one of the strongest in nature. The resulting difficulty of converting (N_2) into other compounds, and the ease (and associated high-energy release) of converting nitrogen compounds into elemental N2, have dominated the role of nitrogen in both nature and human economic activities. At atmospheric pressure molecular nitrogen condenses (liquefies) at 77 K (-195.8 °C) and freezes at 63 K (-210.0 °C) into the beta hexagonal close-packed crystal allotropic form. Below 35.4 K (-237.6 °C) nitrogen assumes the alpha cubic crystal allotropic form. Liquid nitrogen, a fluid resembling water, but with 80.8% of the density, is a common cryogen. Unstable allotropes of nitrogen consisting of more than two nitrogen atoms have been produced in the laboratory, like N3 and N4.[1] Under extremely high pressures (1.1 million atm) and high temperatures (2000 K), as produced under diamond anvil conditions, nitrogen polymerizes into the single bonded diamond crystal structure, an allotrope nicknamed "nitrogen diamond."
NITROGEN-FIXING: Rod-shaped, gram-negative, aerobic; convert atmospheric nitrogen gas to ammonium in soil; include Azotobacter, a common genus.
NO3-: The molecular formula of the Nitrate ion.
NOMENCLATURE: The method of assigning names in the classification of organisms.
NON-CARBONATE HARDNESS: The portion of the total hardness in excess of the alkalinity.
NON-CARBONATE IONS: Water contains non-carbonate ions if it cannot be softened to a desired level through the use of lime only.
NONCOMPETITIVE INHIBITOR: A substance that reduces the activity of an enzyme by binding to a location remote from the active site, changing its conformation so that it no longer binds to the substrate.
NON-POINT SOURCE POLLUTION: Air pollution may leave contaminants on highway surfaces. This non-point source pollution adversely impacts reservoir water and groundwater quality.
NONPOLAR: Electrically symmetrical. For example, in many molecules with covalent bonds, the electrons are shared equally; the poles are electrically neutral.
NONSENSE MUTATION: A mutation that changes an amino acid codon to one of the three stop codons, resulting in a shorter and usually nonfunctional protein.
NORM OF REACTION: The range of phenotypic possibilities for a single genotype, as influenced by the environment.
NORMALITY: It is the number of equivalent weights of solute per liter of solution. Normality highlights the chemical nature of salts: in solution, salts dissociate into distinct reactive species (ions such as H+, Fe3+, or Cl-). Normality accounts for any discrepancy between the concentrations of the various ionic species in a solution. For example, in a salt such as MgCl2, there are two moles of Cl- for every mole of Mg2+, so the concentration of Cl- as well as of Mg2+ is said to be 2 N (read: "two normal"). Further examples are given below. A normal is one gram equivalent of a solute per liter of solution. The definition of a gram equivalent varies depending on the type of chemical reaction that is discussed - it can refer to acids, bases, redox species, and ions that will precipitate. It is critical to note that normality measures a single ion which takes part in an overall solute.
NTU: (Nephelometric turbidity unit)**:** A measure of the clarity or cloudiness of water.
NUCLEAR: 1) (envelope) The surface, consisting of two layers of membrane, that encloses the nucleus of eukaryotic cells. 2) (pore) An opening of the nuclear envelope which allows for the movement of materials between the nucleus and surrounding cytoplasm.
NUCLEIC: (acid) A polymer composed of nucleotides that are joined by covalent bonds (phosphodiester linkages) between the phosphate of one nucleotide and the sugar of the next nucleotide.
NUCLELUS: A small, generally spherical body found within the nucleus of eukaryotic cells. The site of ribosomal RNA synthesis.
NUCLEOID: The region that harbors the chromosome of a prokaryotic cell. Unlike the eukaryotic nucleus, it is not bounded by a membrane.
NUCLEOLUS (pl. nucleoli): A specialized structure in the nucleus, formed from various chromosomes and active in the synthesis of ribosomes.
NUCLEOSIDE: An organic molecule consisting of a nitrogenous base joined to a five- carbon sugar.
NUCLEOSOME: The basic, beadlike unit of DNA packaging in eukaryotes, consisting of a segment of DNA wound around a protein core composed of two copies of each of four types of histone.
NUCLEOTIDE: The basic chemical unit (monomer) of a nucleic acid. A nucleotide in RNA consists of one of four nitrogenous bases linked to ribose, which in turn is linked to phosphate. In DNA, deoxyribose is present instead of ribose.

NUCLEUS: A membrane-bound organelle containing genetic material. Nuclei are a prominent internal structure seen both in *Cryptosporidium* oocysts and *Giardia* cysts. In *Cryptosporidium* oocysts, there is one nucleus per sporozoite. One to four nuclei can be seen in *Giardia* cysts.
NUCLEUS: The membrane bound organelle of eukaryotic cells that contains the cell's genetic material. Also the central region of an atom composed of protons and neutrons.
NULL: In the scientific method, the hypothesis which one attempts to falsify.

O

O_3: The molecular formula of ozone.
OLIGOTROPHIC: A reservoir that is nutrient-poor and contains little plant or animal life. An oligotrophic ecosystem or environment is one that offers little to sustain life. The term is commonly utilized to describe bodies of water or soils with very low nutrient levels. It derives etymologically from the Greek oligo (small, little, few) and trophe (nutrients, food). Oligotrophic environments are of special interest for the alternative energy sources and survival strategies upon which life could rely.
ONGOING PRECISION AND RECOVERY (OPR) STANDARD: A method blank spiked with known quantities of analytes. The OPR is analyzed exactly like a sample. Its purpose is to assure that the results produced by the laboratory remain within the limits specified in this method for precision and recovery.
OOCYST: The encysted zygote of some sporozoa; e.g., *Cryptosporidium*. The oocyst is a phase or form of the organism produced as a normal part of the life cycle of the organism. It is characterized by a thick and environmentally resistant outer wall.
ORGANIC MATTER: Substances containing carbon compounds, usually of animal or vegetable origin.
ORGANIC PRECURSORS: Natural or man-made compounds with chemical structures based upon carbon that, upon combination with chlorine, leading to trihalomethane formation.
ORGANIC: Relating to, or derived from, a living thing. A description of a substance that contains carbon atoms linked together by carbon-carbon bonds.
OSMOSIS: Osmosis is the process by which water moves across a semi permeable membrane from a low concentration solute to a high concentration solute to satisfy the pressure differences caused by the solute.
OXIDE: An oxide is a chemical compound containing at least one oxygen atom as well as at least one other element. Most of the Earth's crust consists of oxides. Oxides result when elements are oxidized by oxygen in air. Combustion of hydrocarbons affords the two principal oxides of carbon, carbon monoxide and carbon dioxide. Even materials that are considered to be pure elements often contain a coating of oxides. For example, aluminum foil has a thin skin of Al2O3 that protects the foil from further corrosion. Virtually all elements burn in an atmosphere of oxygen. In the presence of water and oxygen (or simply air), some elements - lithium, sodium, potassium, rubidium, Caesium, strontium and barium - react rapidly, even dangerously to give the hydroxides. In part for this reason, alkali and alkaline earth metals are not found in nature in their metallic, i.e., native, form. Caesium is so reactive with oxygen that it is used as a getter in vacuum tubes, and solutions of potassium and sodium, so called NaK are used to deoxygenate and dehydrate some organic solvents. The surface of most metals consists of oxides and hydroxides in the presence of air. A well-known example is aluminum foil, which is coated with a thin film of aluminum oxide that passivates the metal, slowing further corrosion. The aluminum oxide layer can be built to greater thickness by the process of electrolytic anodizing. Although solid magnesium and aluminum react slowly with oxygen at STP, they, like most metals, will burn in air, generating very high temperatures. As a consequence, finely divided powders of most metals can be dangerously explosive in air.
OXIDIZING: The process of breaking down organic wastes into simpler elemental forms or by products. Also used to separate combined chlorine and convert it into free chlorine.
OXYGEN DEFICIENT ENVIRONMENT: One of the most dangerous threats to an operator upon entering a manhole.
OZONE: Ozone or trioxygen (O3) is a triatomic molecule, consisting of three oxygen atoms. It is an allotrope of oxygen that is much less stable than the diatomic O2. Ground-level ozone is an air pollutant with harmful effects on the respiratory systems of animals. Ozone in the upper atmosphere filters potentially damaging ultraviolet light from reaching the Earth's surface. It is present in low concentrations throughout the Earth's atmosphere. It has many industrial and consumer applications. Ozone, the first allotrope of a chemical element to be recognized by science, was proposed as a distinct chemical compound by Christian Friedrich Schönbein in 1840, who named it after the Greek word for smell (ozein), from the peculiar odor in lightning storms. The formula for ozone, O3, was not determined until 1865 by Jacques-Louis Soret and confirmed by Schönbein in 1867.

P

PACKING: Material, usually of woven fiber, placed in rings around the shaft of a pump and used to control the leakage from the stuffing box.
PARAMECIUM: Paramecia are a group of unicellular ciliate protozoa formerly known as slipper animalcules from their slipper shape. They are commonly studied as a representative of the ciliate group. Simple cilia cover the body which allows the cell to move with a synchronous motion (like a caterpilla). There is also a deep oral groove containing inconspicuous compound oral cilia (as found in other peniculids) that is used to draw food inside. They generally feed upon bacteria and other small cells. Osmoregulation is carried out by a pair of contractile vacuoles, which actively expel water absorbed by osmosis from their surroundings. Paramecia are widespread in freshwater environments, and are especially common in scums. Paramecia are attracted by acidic conditions. Certain single-celled eukaryotes,

such as Paramecium, are examples for exceptions to the universality of the genetic code (translation systems where a few codons differ from the standard ones).

PARTS PER MILLION (PPM): A common unit of measure used to express the number of parts of a substance contained within a million parts of a liquid, solid, or gas.

PASTEURIZATION: A process for killing pathogenic organisms by applying heat for a specific period of time.

PATHOGENS: Disease-causing pathogens; waterborne pathogens A pathogen may contaminate water and cause waterborne disease.

Pb: The chemical symbol of Lead.

PCE: abbr. perchloroethylene. Known also as perc or tetrachloroethylene, perchloroethylene is a clear, colorless liquid with a distinctive, somewhat ether-like odor. It is non-flammable, having no measurable flashpoint or flammable limits in air. Effective over a wide range of applications, perchloroethylene is supported by closed loop transfer systems, stabilizers and employee exposure monitoring.

pCi/L: Picocuries per liter A curie is the amount of radiation released by a set amount of a certain compound. A picocurie is one quadrillionth of a curie.

PEAK DEMAND: The maximum momentary load placed on a water treatment plant, pumping station or distribution system.

PERKINESIS: The aggregation resulting from random thermal motion of fluid molecules.

PERMEATE: The term for water which has passed through the membrane of a reverse osmosis unit. The liquid that passes through a membrane.

PERMISSIBLE EXPOSURE LIMIT (PEL or OSHA PEL): A legal limit in the United States for exposure of an employee to a substance or physical agent. For substances it is usually expressed in parts per million (ppm), or sometimes in milligrams per cubic meter (mg/m^3). Units of measure for physical agents such as noise are specific to the agent. Permissible Exposure Limits are established by the Occupational Safety and Health Administration (OSHA).

pH OF SATURATION: The ideal pH for perfect water balance in relation to a particular total alkalinity level and a particular calcium hardness level, at a particular temperature. The pH where the Langelier Index equals zero.

pH: A unit of measure which describes the degree of acidity or alkalinity of a solution. The pH scale runs from 0 to 14 with 7 being the mid-point or neutral. A pH of less than 7 is on the acid side of the scale with 0 as the point of greatest acid activity. A pH of more than 7 is on the basic (alkaline) side of the scale with 14 as the point of greatest basic activity. The term pH is derived from “p”, the mathematical symbol of the negative logarithm, and “H”, the chemical symbol of Hydrogen. The definition of pH is the negative logarithm of the Hydrogen ion activity. $pH=-log[H^+]$.

PHENOL RED: Chemical reagent used for testing pH in the range of 6.8 - 8.4.

PHENOLPHTHALEIN/TOTAL ALKALINITY: The relationship between the alkalinity constituent’s bicarbonate, carbonate, and hydroxide can be based on the P and T alkalinity measurement.

PHOSPHATE, NITRATE AND ORGANIC NITROGEN: Nutrients in a domestic water supply reservoir may cause water quality problems if they occur in moderate or large quantities.

PHYSICAL CHEMICAL TREATMENT: Treatment processes that are non-biological in nature.

PICOCURIE: A unit of radioactivity. "Pico" is a metric prefix that means one one-millionth of one one-millionth. A picocurie is one one-millionth of one one-millionth of a Curie. A Curie is that quantity of any radioactive substance that undergoes 37 billion nuclear disintegrations per second. Thus a picocurie is that quantity of any radioactive substance that undergoes 0.037 nuclear disintegrations per second.

PIEZOMETRIC SURFACE: See potentiometric surface.

PIN FLOC: Small flocculated particle size.

PLATE AND FRAME PRESS: A batch process dewatering device in which sludge is pumped under high pressure through a series of parallel plates, in which a chamber is created between the plates. Each plate is fitted with filter cloth and the solids are collected in the chambers and the water is filtered from the sludge.

POINT SOURCE DISCHARGE: A pipe, ditch, channel or other container from which pollutants may be discharged.

POLLUTANT: A substance, organism or energy form present in amounts that impair or threaten an ecosystem to the extent that its current or future uses are prevented.

POLLUTION: To make something unclean or impure. See Contaminated.

POLYMER: A type of chemical when combined with other types of coagulants aid in binding small suspended particles to larger particles to help in the settling and filtering processes. Chemical used for flocculation in dewatering. Also known as a "polyelectrolyte" which is a substance made of giant molecules formed by the union of simple smaller molecules.

POLYPHOSPHATES: Chemicals that may be added to remove low levels of iron and manganese.

PORE SPACE: The interstitial space between sediments and fractures that is capable of storing and transmitting water.

POROSITY: A factor representing a rock, soil, or formations percentage of open space available for the percolation and storage of groundwater.

POSITIVE CONTROL: See Ongoing precision and recovery standard.

POST TREATMENT: Treatment of finished water or wastewater to further enhance its quality.

POST-CHLORINE: Where the water is chlorinated to make sure it holds a residual in the distribution system.

POTABLE: Good water which is safe for drinking or cooking purposes. Non-Potable: A liquid or water that is not approved for drinking.
POTENTIAL ENERGY: The energy that a body has by virtue of its position or state enabling it to do work.
POWDERED ACTIVATED CARDON TREATMENT (PACT): A wastewater technology in which powdered activated carbon is added to an anaerobic or aerobic treatment system. The carbon in the biological treatment process acts as a "buffer" against the effects of toxic organics in the wastewater.
PPM: Abbreviation for parts per million.
PRE-CHLORINATION: The addition of chlorine before the filtration process will help:
PRE-CHLORINE: Where the raw water is dosed with a large concentration of chlorine.
PRECIPITATE: A solid that separates from a solution.
PRECIPTATION: The phenomenon that occurs when a substance held in solution passes out of solution into a solid form.
PRELIMINARY TREATMENT: Treatment steps including comminution, screening, grit removal, pre-aeration, and/or flow equalization that prepares wastewater influent for further treatment.
PRESSURE FILTER: Filter unit enclosed in a vessel that may be operated under pressure.
PRESSURE HEAD: The height of a column of water capable of being maintained by pressure. See also Total Head, Total Dynamic Head.
PRESSURE MEASUREMENT: Bourdon tube, Bellows gauge and Diaphragm are commonly used to measure pressure in waterworks systems. A Bellows-type sensor reacts to a change in pressure.
PRESSURE: Pressure is defined as force per unit area. It is usually more convenient to use pressure rather than force to describe the influences upon fluid behavior. The standard unit for pressure is the Pascal, which is a Newton per square meter. For an object sitting on a surface, the force pressing on the surface is the weight of the object, but in different orientations it might have a different area in contact with the surface and therefore exert a different pressure.
PREVENTION: To take action. Stop something before it happens.
PRIMARY CLARIFIER: Sedimentation basin that precedes secondary wastewater treatment.
PRIMARY SLUDGE: Sludge produced in a primary waste treatment unit.
PRIMARY TREATMENT: Treatment steps including sedimentation and/or fine screening to produce an effluent suitable for biological treatment.
PROCESS WASTEWATER: Wastewater generated during manufacture or production processes.
PROCESS WATER: Water that is used for, or comes in contact with an end product or the materials used in an end product.
PROPIONIC ACID: Rod-shaped, pleomorphic, gram-positive, anaerobic; ferment lactic acid; fermentation produces holes in Swiss cheese from the production of carbon dioxide.
PROTON, NEUTRON AND ELECTRON: Are the 3 fundamental particles of an atom.
PROTOZOA: Microscopic animals that occur as single cells. Some protozoa can cause disease in humans. Protozoa form cysts, which are specialized cells like eggs that are very resistant to chlorine. Cysts can survive the disinfection process, then "hatch" into normal cells that can cause disease. Protozoa must be removed from drinking water by filtration, because they cannot be effectively killed by chlorine.
PSEUDOMONAD: Rod-shaped (straight or curved) with polar flagella, gram-negative, aerobic; can use up to 100 different compounds for carbon and energy.
PTFE: Polytetrafluoroethylene.
PUMPING LIFT: The height to which water must be pumped or lifted to, feet of head.
Q
QUANTITATIVE TRANSFER: The process of transferring a solution from one container to another using a pipette in which as much solution as possible is transferred, followed by rinsing of the walls of the source container with a small volume of rinsing solution (e.g., reagent water, buffer, etc.), followed by transfer of the rinsing solution, followed by a second rinse and transfer.
QUICKLIME: A calcium oxide material produced by calcining limestone to liberate carbon dioxide, also called “calcined lime” or “pebble lime”, commonly used for pH adjustment. Chemical formula is CaO.
QUICKLIME: A calcium oxide material produced by calcining limestone to liberate carbon dioxide, also called “calcined lime” or “pebble lime”, commonly used for pH adjustment. Chemical formula is CaO.
R
RADON: A gas that can dissolve and accumulate in underground water sources, such as wells, and in the air in your home. Breathing radon can cause lung cancer. Drinking water containing radon presents a risk of developing cancer. Radon in air is more dangerous than radon in water.
RAW SEWAGE: Untreated wastewater and its contents.
RAW SLUDGE: Undigested sludge recently removed from a sedimentation basin.
RAW TURBIDITY: The turbidity of the water coming to the treatment plant from the raw water source.
RAW WATER: Untreated surface or groundwater.
REAGENT WATER BLANK: see Method blank.

REAGENT WATER: Water demonstrated to be free from the analytes of interest and potentially interfering substances at the method detection limit for the analyte.
REAGENT: A substance used in a chemical reaction to measure, detect, examine, or produce other substances.
RECLAIMED WATER: Wastewater that has been treated to a level that allows for its reuse for a beneficial purpose.
RECLAMATION: The process of improving or restoring the condition of land or other material to a better or more useful state.
RECOMMENDED EXPOSURE LIMIT (REL): An occupational exposure limit that has been recommended by the U.S. National Institute for Occupational Safety and Health to OSHA for adoption as a Permissible Exposure Limit. The REL is a level that NIOSH believes would be protective of worker safety and health over a working lifetime if used in combination with engineering and work practice controls, exposure and medical monitoring, posting and labeling of hazards, worker training and personal protective equipment. No REL has ever been adopted by OSHA, but they have been used as guides by some industry and advocacy organizations.
RECYCLING: The process by which recovered materials are transformed into new products.
REDOX POTENTIAL: Reduction potential (also known as redox potential, oxidation / reduction potential or ORP) is the tendency of a chemical species to acquire electrons and thereby be reduced. Each species has its own intrinsic reduction potential; the more positive the potential, the greater the species' affinity for electrons and tendency to be reduced. In aqueous solutions, the reduction potential is the tendency of the solution to either gain or lose electrons when it is subject to change by introduction of a new species. A solution with a higher (more positive) reduction potential than the new species will have a tendency to gain electrons from the new species (i.e. to be reduced by oxidizing the new species) and a solution with a lower (more negative) reduction potential will have a tendency to lose electrons to the new species (i.e. to be oxidized by reducing the new species). Just as the transfer of hydrogen ions between chemical species determines the pH of an aqueous solution, the transfer of electrons between chemical species determines the reduction potential of an aqueous solution. Like pH, the reduction potential represents an intensity factor. It does not characterize the capacity of the system for oxidation or reduction, in much the same way that pH does not characterize the buffering capacity.
RELATIVE STANDARD DEVIATION (RSD): The standard deviation divided by the mean times 100.
RELAY LOGIC: The name of a popular method of automatically controlling a pump, valve, chemical feeder, and other devices.
RESERVOIR: An impoundment used to store water.
RESIDENCE TIME: The period of time that a volume of liquid remains in a tank or system.
RESPIRATION: Intake of oxygen and discharge of carbon dioxide as a result of biological oxidation.
RETURN ACTIVATED SLUDGE: Settled activated sludge that is returned to mix with raw or primary settled wastewater.
RICKETTSIA: Spherical or rod-shaped, gram-negative, aerobic; cause Rocky Mountain spotted fever and typhus; closely related to Agrobacterium, a common gall-causing plant bacterium.
ROBERT HOOKE: Coined the term "cell" to describe the structures he saw while examining a piece of cork using a microscope.
ROTARY DRUM SCREEN: Cylindrical screen used to remove floatable and suspended solids.
ROTIFER: Rotifers get their name (derived from Greek and meaning "wheel-bearer"; they have also been called wheel animalcules) from the corona, which is composed of several ciliated tufts around the mouth that in motion resemble a wheel. These create a current that sweeps food into the mouth, where it is chewed up by a characteristic pharynx (called the mastax) containing a tiny, calcified, jaw-like structure called the trophi. The cilia also pull the animal, when unattached, through the water. Most free-living forms have pairs of posterior toes to anchor themselves while feeding. Rotifers have bilateral symmetry and a variety of different shapes. There is a well-developed cuticle which may be thick and rigid, giving the animal a box-like shape, or flexible, giving the animal a worm-like shape; such rotifers are respectively called loricate and illoricate.

S

SANITARY SURVEY: Persons trained in public health engineering and the epidemiology of waterborne diseases should conduct the sanitary survey. The importance of a detailed sanitary survey of a new water source cannot be overemphasized. An on-site review of the water sources, facilities, equipment, operation, and maintenance of a public water systems for the purpose of evaluating the adequacy of the facilities for producing and distributing safe drinking water. The purpose of a non-regulatory sanitary survey is to identify possible biological and chemical pollutants which might affect a water supply.
SANITIZER: A disinfectant or chemical which disinfects (kills bacteria), kills algae and oxidizes organic matter.
SATURATED ZONE: Where an unconfined aquifer becomes saturated beneath the capillary fringe.
SATURATION INDEX: See Langelier's Index.
SATURATOR: A device which produces a fluoride solution for the fluoride process. Crystal-grade types of sodium fluoride should be fed with a saturator. Overfeeding must be prevented to protect public health when using a fluoridation system.

SCADA: A remote method of monitoring pumps and equipment. 130 degrees F is the maximum temperature that transmitting equipment is able to with stand. If the level controller may be set with too close a tolerance 45 could be the cause of a control system that is frequently turning a pump on and off.
SCALE: Crust of calcium carbonate, the result of unbalanced water. Hard insoluble minerals deposited (usually calcium bicarbonate) which forms on pool and spa surfaces and clog filters, heaters and pumps. Scale is caused by high calcium hardness and/or high pH. The regular use of stain prevention chemicals can prevent scale.
SCREENINGS PRESS: A mechanical press used to compact and/or dewater material removed from mechanical screening equipment.
SCROLL AND BASKET: The two basic types of centrifuges used in water treatment.
SCRUBBER: A device used to removal particulates or pollutant gases from combustion or chemical process exhaust streams.
SCUM: Floatable materials found on the surface of primary and secondary settling tanks consisting of food wastes, grease, fats, paper, foam, and similar matter.
SECONDARY CLARIFIER: A clarifier following a secondary treatment process, designed for gravity removal of suspended matter.
SECONDARY SLUDGE: The sludge from the secondary clarifier in a wastewater treatment plant.
SECONDARY TREATMENT: The treatment of wastewater through biological oxidation after primary treatment.
SEDIMENT: Grains of soil, sand, gravel, or rock deposited by and generated by water movement.
SEDIMENTATION BASIN: A quiescent tank used to remove suspended solids by gravity settling. Also called clarifiers or settling tanks, they are usually equipped with a motor driven rake mechanism to collect settled sludge and move it to a central discharge point.
SEDIMENTATION BASIN: Where the thickest and greatest concentration of sludge will be found. Twice a year sedimentation tanks should be drained and cleaned if the sludge buildup interferes with the treatment process.
SEDIMENTATION: The process of suspended solid particles settling out (going to the bottom of the vessel) in water.
SEDIMENTATION: The removal of settleable suspended solids from water or wastewater by gravity in a quiescent basin or clarifier.
SENSOR: A float and cable system are commonly found instruments that may be used as a sensor to control the level of liquid in a tank or basin.
SEPTIC: Condition characterized by bacterial decomposition under anaerobic conditions.
SETTLEABILITY: The tendency of suspended solids to settle.
SETTLEABLE SOLIDS: That portion of suspended solids which are of a sufficient size and weight to settle to the bottom of an Imhoff cone in one hour.
SETTLED SLUDGE VOLUME: Volume of settled sludge measured at predetermined time increments for use in process control calculations.
SETTLED SOLIDS: Solids that have been removed from the raw water by the coagulation and settling processes.
SEWAGE: Liquid or waterborne wastes polluted or fouled from households, commercial or industrial operations, along with any surface water, storm water or groundwater infiltration.
SEWER GAS: A gas mixture produced by anaerobic decomposition of organic matter usually containing high percentages of methane and hydrogen sulfide.
SHEATHED: Filamentous, gram-negative, aerobic; “swarmer” (colonizing) cells form and break out of a sheath; sometimes coated with metals from environment.
SHOCK LOAD: A sudden hydraulic or organic load to a treatment plant, also descriptive of a change in the material being treated.
SHOCK: Also known as superchlorination or break point chlorination. Ridding a water of organic waste through oxidization by the addition of significant quantities of a halogen.
SHORT-CIRCUITING: Short Circuiting is a condition that occurs in tanks or basins when some of the water travels faster than the rest of the flowing water. This is usually undesirable since it may result in shorter contact, reaction or settling times in comparison with the presumed detention times.
SHOULD: This action, activity, or procedural step is suggested but not required.
SINGLE PHASE POWER: The type of power used for lighting systems, small motors, appliances, portable power tools and in homes.
SLOP OIL: Separator skimmings and tramp oil generated during refinery startup, shutdown or abnormal operation.
SLUDGE BASINS: After cleaning sludge basins and before returning the tanks into service the tanks should be inspected, repaired if necessary, and disinfected.
SLUDGE BLANKET: The accumulated sludge suspended in a clarifier or other enclosed body of water.
SLUDGE DEWATERING: The removal of a portion or majority of the water contained in sludge by means of a filter press, centrifuge or other mechanism.
SLUDGE DRYING BED: A closed area consisting of sand or other porous material upon which sludge is dewatered by gravity drainage and evaporation.
SLUDGE REDUCTION: Organic polymers are used to reduce the quantity of sludge. If a plant produces a large volume of sludge, the sludge could be dewatered, thickened, or conditioned to decrease the volume of sludge.

Turbidity of source water, dosage, and type of coagulant used are the most important factors which determine the amount of sludge produced in a treatment of water.
SLUDGE: Accumulated and concentrated solids generated within a treatment process that have not undergone a stabilization process.
SLURRY: A mixture of a solid and a liquid that facilitates the transfer of the solid into a treatment solution.
SOC: A common way for a synthetic organic chemical such as dioxin to be introduced to a surface water supply is from an industrial discharge, agricultural drainage, or a spill.
SODA ASH: Chemical used to raise pH and total alkalinity (sodium carbonate)
SODIUM BICARBONATE: Commonly used to increase alkalinity of water and stabilize pH.
SODIUM BISULFATE: Chemical used to lower pH and total alkalinity (dry acid).
SODIUM HYDROXIDE: Also known as caustic soda, a by-product chlorine generation and often used to raise pH.
SOFTENING WATER: When the water has a low alkalinity, it is advantageous to use soda ash instead of caustic soda for softening water.
SOFTENING: The process that removes the ions which cause hardness in water.
SOLID WASTE: Garbage, refuse, sludge and other discarded material resulting from community activities or commercial or industrial operations.
SOLID, LIQUID AND VAPOR: 3 forms of matter.
SOLUBILITY: The amount of a substance that can dissolve in a solution under a given set of conditions.
SPADNS: The lab reagent called SPADNS solution is used in performing the Fluoride test.
SPIKING SUSPENSION: Diluted stock suspension containing the organism(s) of interest at a concentration appropriate for spiking samples.
SPIRILLUM: Spiral-shaped, gram-negative, aerobic; include Bdellovibrio, predatory on other bacteria.
SPIROCHETE: Spiral-shaped, gram-negative, mostly anaerobic; common in moist environments, from mammalian gums to coastal mudflats; complex internal structures convey rapid movement; include *Treponemapallidum,* cause of syphilis.
SPOROZOITE: A motile, infective stage of certain protozoans; e.g., *Cryptosporidium*. There are four sporozoites in each *Cryptosporidium* oocyst, and they are generally banana-shaped.
SPRAY BOTTLE OF AMMONIA: An operator should use ammonia to test for a chlorine leak around a valve or pipe. You will see white smoke if there is a leak.
SPRING PRESSURE: Is what maintains contact between the two surfaces of a mechanical seal.
STABILIZATION POND: A large shallow basin used for wastewater treatment by natural processes involving the use of algae and bacteria to accomplish biological oxidation of organic matter.
STERILIZED GLASSWARE: The only type of glassware that should be used in testing for coliform bacteria.
STOCK SUSPENSION: A concentrated suspension containing the organism(s) of interest that is obtained from a source that will attest to the host source, purity, authenticity, and viability of the organism(s).
STUFFING BOX: That portion of the pump that houses the packing or mechanical seal.
SUBNATANT: Liquid remaining beneath the surface of floating solids.
SUCCESSION: Transition in the species composition of a biological community, often following ecological disturbance of the community; the establishment of a biological community in an area virtually barren of life.
SULFATE- AND SULFUR- REDUCING: Commonly rod-shaped, mostly gram-negative, anaerobic; include *Desulfovibrio,* ecologically important in marshes.
SULFIDE: The term sulfide refers to several types of chemical compounds containing sulfur in its lowest oxidation number of -2. Formally, "sulfide" is the dianion, S2-, which exists in strongly alkaline aqueous solutions formed from H2S or alkali metal salts such as Li2S, Na2S, and K2S. Sulfide is exceptionally basic and, with a pKa > 14, it does not exist in appreciable concentrations even in highly alkaline water, being undetectable at pH < ~15 (8 M NaOH). Instead, sulfide combines with electrons in hydrogen to form HS, which is variously called hydrogen sulfide ion, hydrosulfide ion, sulfhydryl ion, or bisulfide ion. At still lower pH's (<7), HS- converts to H2S, hydrogen sulfide. Thus, the exact sulfur species obtained upon dissolving sulfide salts depends on the pH of the final solution. Aqueous solutions of transition metals cations react with sulfide sources (H2S, NaSH, Na2S) to precipitate solid sulfides. Such inorganic sulfides typically have very low solubility in water and many are related to minerals. One famous example is the bright yellow species CdS or "cadmium yellow". The black tarnish formed on sterling silver is Ag2S. Such species are sometimes referred to as salts. In fact, the bonding in transition metal sulfides is highly covalent, which gives rise to their semiconductor properties, which in turn is related to the practical applications of many sulfide materials.
SULFUR- AND IRON- OXIDIZING: Commonly rod-shaped, frequently with polar flagella, gram-negative, mostly anaerobic; most live in neutral (nonacidic) environment.
SUPERNATANT: The liquid layer which forms above the sludge in a settling basin.
SURFACE SEAL: The upper portion of a wells construction where surface contaminants are adequately prevented from entering the well, normally consisting of surface casing and neat cement grout.
SURFACTANT: Surfactants reduce the surface tension of water by adsorbing at the liquid-gas interface. They also reduce the interfacial tension between oil and water by adsorbing at the liquid-liquid interface. Many surfactants can also assemble in the bulk solution into aggregates. Examples of such aggregates are vesicles and micelles. The

concentration at which surfactants begin to form micelles is known as the critical micelle concentration or CMC. When micelles form in water, their tails form a core that can encapsulate an oil droplet, and their (ionic/polar) heads form an outer shell that maintains favorable contact with water. When surfactants assemble in oil, the aggregate is referred to as a reverse micelle. In a reverse micelle, the heads are in the core and the tails maintain favorable contact with oil. Surfactants are also often classified into four primary groups; anionic, cationic, non-ionic, and zwitterionic (dual charge).

SUSPENDED SOLIDS: Solids captured by filtration through a 0.45 micron filter membrane.

T

TCE, *trichloroethylene:* A solvent and degreaser used for many purposes; for example dry cleaning, it is a common groundwater contaminant. Trichloroethylene is a colorless liquid which is used as a solvent for cleaning metal parts. Drinking or breathing high levels of trichloroethylene may cause nervous system effects, liver and lung damage, abnormal heartbeat, coma, and possibly death. Trichloroethylene has been found in at least 852 of the 1,430 National Priorities List sites identified by the Environmental Protection Agency (EPA).

TDS-TOTAL DISSOLVED SOLIDS: An expression for the combined content of all inorganic and organic substances contained in a liquid which are present in a molecular, ionized or micro-granular (colloidal sol) suspended form. Generally, the operational definition is that the solids (often abbreviated TDS) must be small enough to survive filtration through a sieve size of two micrometers. Total dissolved solids are normally only discussed for freshwater systems, since salinity comprises some of the ions constituting the definition of TDS. The principal application of TDS is in the study of water quality for streams, rivers and lakes, although TDS is generally considered not as a primary pollutant (e.g. it is not deemed to be associated with health effects), but it is rather used as an indication of aesthetic characteristics of drinking water and as an aggregate indicator of presence of a broad array of chemical contaminants.

TELEMETERING: The use of a transmission line with remote signaling to monitor a pumping station or motors. Can be used to accomplish accurate and reliable remote monitoring and control over a long distribution system.

TEMPERATURE SAMPLE: This test should be performed immediately in the field, a grab sample.

TERTIARY TREATMENT: The use of physical, chemical, or biological means to improve secondary wastewater effluent quality.

The addition of chlorine to the water prior to any other plant treatment processes.

THE RATE DECREASES: In general, when the temperature decreases, the chemical reaction rate decreases also.

THICKENING, CONDITIONING AND DEWATERING: Common processes that are utilized to reduce the volume of sludge.

THICKENING: A procedure used to increase the solids content of sludge by removing a portion of the liquid.

TIME FOR TURBIDITY BREAKTHROUGH AND MAXIMUM HEADLOSS: Are the two factors which determine whether or not a change in filter media size should be made.

TITRATION: A method of testing by adding a reagent of known strength to a water sample until a specific color change indicates the completion of the reaction.

TOTAL ALKALINITY: A measure of the acid-neutralizing capacity of water which indicates its buffering ability, i.e. measure of its resistance to a change in pH. Generally, the higher the total alkalinity, the greater the resistance to pH change.

TOTAL COLIFORM: Total coliform, fecal coliform, and E. coli are all indicators of drinking water quality. The total coliform group is a large collection of different kinds of bacteria. Fecal coliforms are types of total coliform that mostly exist in feces. E. coli is a sub-group of fecal coliform. When a water sample is sent to a lab, it is tested for total coliform. If total coliform is present, the sample will also be tested for either fecal coliform or E. coli, depending on the lab testing method.

TOTAL DISSOLVED SOLIDS (TDS): The accumulated total of all solids that might be dissolved in water. The weight per unit volume of all volatile and non-volatile solids dissolved in a water or wastewater after a sample has been filtered to remove colloidal and suspended solids.

TOTAL DYNAMIC HEAD: The pressure (psi) or equivalent feet of water, required for a pump to lift water to its point of storage overcoming elevation head, friction loss, line pressure, drawdown and pumping lift.

TOTAL SOLIDS: The sum of dissolved and suspended solids in a water or wastewater.

TOTAL SUSPENDED SOLIDS: The measure of particulate matter suspended in a sample of water or wastewater.

TOXIC: Capable of causing an adverse effect on biological tissue following physical contact or absorption.

TRANSIENT, NON-COMMUNITY WATER SYSTEM: TNCWS A water system which provides water in a place such as a gas station or campground where people do not remain for long periods of time. These systems do not have to test or treat their water for contaminants which pose long-term health risks because fewer than 25 people drink the water over a long period. They still must test their water for microbes and several chemicals. A Transient Non-community Water System: Is not required to sample for VOC's.

TREATABILITY STUDY: A study in which a waste is subjected to a treatment process to determine treatment and/or to determine the treatment efficiency or optimal process conditions for treatment.

TRIHALOMETHANES (THM): Four separate compounds including chloroform, dichlorobromomethane, dibromochloromethane, and bromoform. The most common class of disinfection by-products created when chemical disinfectants react with organic matter in water during the disinfection process. See Disinfectant Byproducts.

TUBE SETTLERS: This modification of the conventional process contains many metal tubes that are placed in the sedimentation basin, or clarifier. These tubes are approximately 1 inch deep and 36 inches long, split-hexagonal shape and installed at an angle of 60 degrees or less. These tubes provide for a very large surface area upon which particles may settle as the water flows upward. The slope of the tubes facilitates gravity settling of the solids to the bottom of the basin, where they can be collected and removed. The large surface settling area also means that adequate clarification can be obtained with detention times of 15 minutes or less. As with conventional treatment, this sedimentation step is followed by filtration through mixed media.
TUBERCLES: The creation of this condition is of the most concern regarding corrosive water effects on a water system. Tubercles are formed due to joining dissimilar metals, causing electro-chemical reactions. Like iron to copper pipe. We have all seen these little rust mounds inside cast iron pipe.
TURBIDIMETER: Monitoring the filter effluent turbidity on a continuous basis with an in-line instrument is a recommended practice. Turbidimeter is best suited to perform this measurement.
TURBIDITY: A measure of the cloudiness of water caused by suspended particles. A qualitative measurement of water clarity which results from suspended matter that scatters or otherwise interferes with the passage of light through the water.
TURBIDITY: Turbidity can interfere with disinfection and provide a medium for microbial growth. Turbidity may indicate the presence of disease causing organisms. These organisms include bacteria, viruses, and parasites that can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.

U

U.S. ENVIRONMENTAL PROTECTION AGENCY: In the United States, this agency responsible for setting drinking water standards and for ensuring their enforcement. This agency sets federal regulations which all state and local agencies must enforce.
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ULTRAFILTRATION: A low pressure membrane filtration process which separates solutes up to 0.1 micron size range.
UNDER PRESSURE IN STEEL CONTAINERS: After chlorine gas is manufactured, it is primarily transported in steel containers.
UP FLOW CLARIFIER: Clarifier where flocculated water flows upward through a sludge blanket to obtain floc removal by contact with flocculated solids in the blanket.

V

VANE: That portion of an impeller that throws the water toward the volute.
VAPOR: The gaseous phase of a material that is in the solid or liquid state at standard temperature and pressure.
VARIABLE DISPLACEMENT PUMP: A pump that will produce different volumes of water dependent on the pressure head against it.
VELOCITY HEAD: The vertical distance a liquid must fall to acquire the velocity with which it flows through the piping system. For a given quantity of flow, the velocity head will vary indirectly as the pipe diameter varies.
VENTURI: If water flows through a pipeline at a high velocity, the pressure in the pipeline is reduced. Velocities can be increased to a point that a partial vacuum is created.
VERTICAL TURBINE: A type of variable displacement pump in which the motor or drive head is mounted on the wellhead and rotates a drive shaft connected to the pump impellers.
VIBRIO: Rod- or comma-shaped, gram-negative, aerobic; commonly with a single flagellum; include *Vibrio cholerae,* cause of cholera, and luminescent forms symbiotic with deep-water fishes and squids.
VIRUSES: Very small disease-causing microorganisms that are too small to be seen even with microscopes. Viruses cannot multiply or produce disease outside of a living cell.
VIRUSES: are very small disease-causing microorganisms that are too small to be seen even with microscopes. Viruses cannot multiply or produce disease outside of a living cell.
VITRIFICATION: Vitrification is a process of converting a material into a glass-like amorphous solid that is free from any crystalline structure, either by the quick removal or addition of heat, or by mixing with an additive. Solidification of a vitreous solid occurs at the glass transition temperature (which is lower than melting temperature, Tm, due to supercooling). When the starting material is solid, vitrification usually involves heating the substances to very high temperatures. Many ceramics are produced in such a manner. Vitrification may also occur naturally when lightning strikes sand, where the extreme and immediate heat can create hollow, branching rootlike structures of glass, called fulgurite. When applied to whiteware ceramics, vitreous means the material has an extremely low permeability to liquids, often but not always water, when determined by a specified test regime. The microstructure of whiteware ceramics frequently contain both amorphous and crystalline phases.
VOID: An opening, gap, or space within rock or sedimentary formations formed at the time of origin or deposition.
VOLATILE ORGANIC COMPOUNDS (VOCs): Solvents used as degreasers or cleaning agents. Improper disposal of VOCs can lead to contamination of natural waters. VOCs tend to evaporate very easily. This characteristic gives VOCs very distinct chemical odors like gasoline, kerosene, lighter fluid, or dry cleaning fluid. Some VOCs are suspected cancer-causing agents. Volatile organic compounds (VOCs) are organic chemical compounds that have

high enough vapor pressures under normal conditions to significantly vaporize and enter the atmosphere. A wide range of carbon-based molecules, such as aldehydes, ketones, and other light hydrocarbons are VOCs. The term often is used in a legal or regulatory context and in such cases the precise definition is a matter of law. These definitions can be contradictory and may contain "loopholes"; e.g. exceptions, exemptions, and exclusions. The United States Environmental Protection Agency defines a VOC as any organic compound that participates in a photoreaction; others believe this definition is very broad and vague as organics that are not volatile in the sense that they vaporize under normal conditions can be considered volatile by this EPA definition. The term may refer both to well characterized organic compounds and to mixtures of variable composition.

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VOLATILE: A substance that evaporates or vaporizes at a relatively low temperature.

VOLTAGE: Voltage (sometimes also called electric or electrical tension) is the difference of electrical potential between two points of an electrical or electronic circuit, expressed in volts.[1] It measures the potential energy of an electric field to cause an electric current in an electrical conductor. Depending on the difference of electrical potential it is called extra low voltage, low voltage, high voltage or extra high voltage. Specifically Voltage is equal to energy per unit charge.

VOLUTE: The spiral-shaped casing surrounding a pump impeller that collects the liquid discharge by the impeller.

VORTEX: The helical swirling of water moving towards a pump.

VORTICELLA: Vorticella is a genus of protozoa, with over 100 known species. They are stalked inverted bell-shaped ciliates, placed among the peritrichs. Each cell has a separate stalk anchored onto the substrate, which contains a contracile fibril called a myoneme. When stimulated this shortens, causing the stalk to coil like a spring. Reproduction is by budding, where the cell undergoes longitudinal fission and only one daughter keeps the stalk. Vorticella mainly lives in freshwater ponds and streams - generally anywhere protists are plentiful. Other genera such as Carchesium resemble Vorticella but are branched or colonial.

VULNERABILITY ASSESSMENT: An evaluation of drinking water source quality and its vulnerability to contamination by pathogens and toxic chemicals.

W

WAIVERS: Monitoring waivers for nitrate and nitrite are prohibited.

WASTE ACTIVATED SLUDGE: Excess activated sludge that is discharged from an activated sludge treatment process.

WASTEWATER: Liquid or waterborne wastes polluted or fouled from households, commercial or industrial operations, along with any surface water, storm water or groundwater infiltration.

WATER HAMMER: A surge in a pipeline resulting from the rapid increase or decrease in water flow. Water hammer exerts tremendous force on a system and can be highly destructive.

WATER PURVEYOR: The individuals or organization responsible to help provide, supply, and furnish quality water to a community.

WATER QUALITY CRITERIA: Comprised of both numeric and narrative criteria. Numeric criteria are scientifically derived ambient concentrations developed by EPA or States for various pollutants of concern to protect human health and aquatic life. Narrative criteria are statements that describe the desired water quality goal.

WATER QUALITY STANDARD: A statute or regulation that consists of the beneficial designated use or uses of a waterbody, the numeric and narrative water quality criteria that are necessary to protect the use or uses of that particular waterbody, and an antidegradation statement.

WATER QUALITY: The 4 broad categories of water quality are: Physical, chemical, biological, radiological.
Pathogens are disease causing organisms such as bacteria and viruses. A positive bacteriological sample indicates the presence of bacteriological contamination. Source water monitoring for lead and copper be performed when a public water system exceeds an action level for lead of copper.

WATER RECLAMATION: The restoration of wastewater to a state that will allow its beneficial reuse.

WATER VAPOR: A characteristic that is unique to water vapor in the atmosphere is that water does not contain any salts.

WATERBORNE DISEASE: A disease, caused by a virus, bacterium, protozoan, or other microorganism, capable of being transmitted by water (e.g., typhoid fever, cholera, amoebic dysentery, gastroenteritis).

WATERSHED: An area that drains all of its water to a particular water course or body of water. The land area from which water drains into a stream, river, or reservoir.
WAVE FUNCTION: A function describing the electron's position in a three-dimensional space.
WHOLE EFFLUENT TOXICITY: The total toxic effect of an effluent measured directly with a toxicity test.
WPCF: Water Pollution Control Facility
WTP: Water Treatment Plant
WWTP: Wastewater Treatment Plant

X

X-RAY DIFFRACTION: A method for establishing structures of crystalline solids using singe wavelength X-rays and looking at diffraction pattern.
X-RAY PHOTOELECTRON SPECTROSCOPY: A spectroscopic technique to measure composition of a material.
X-RAY: Form of ionizing, electromagnetic radiation, between gamma and UV rays.

Y

YIELD: The amount of product produced during a chemical reaction.

Z

ZERO DISCHARGE: A facility that discharges no liquid effluent to the environment.
ZONE MELTING: A way to remove impurities from an element by melting it and slowly travel down an ingot (cast).
ZWITTERION: Is a chemical compound whose net charge is zero and hence is electrically neutral. But there are some positive and negative charges in it, due to the formal charge, owing to the partial charges of its constituent atoms.

Math Conversion Factors

1 PSI = 2.31 Feet of Water
1 Foot of Water = .433 PSI
1.13 Feet of Water = 1 Inch of Mercury
454 Grams = 1 Pound
2.54 CM =Inch
1 Gallon of Water = 8.34 Pounds
1 mg/L = 1 PPM
17.1 mg/L = 1 Grain/Gallon
1% = 10,000 mg/L
694 Gallons per Minute = MGD
1.55 Cubic Feet per Second = 1 MGD
60 Seconds = 1 Minute
1440 Minutes = 1 Day
.746 kW = 1 Horsepower

LENGTH
12 Inches = 1 Foot
3 Feet = 1 Yard
5280 Feet = 1 Mile

AREA
144 Square Inches = 1 Square Foot
43,560 Square Feet =1 Acre

VOLUME
1000 Milliliters = 1 Liter
3.785 Liters = 1 Gallon
231 Cubic Inches = 1 Gallon
7.48 Gallons = 1 Cubic Foot of water
62.38 Pounds = 1 Cubic Foot of water

Dimensions

SQUARE: Area (sq. ft.) = Length X Width
Volume (cu.ft.) = Length (ft) X Width (ft) X Height (ft)

CIRCLE: Area (sq. ft.) = 3.14 X Radius (ft) X Radius (ft)

CYLINDER: Volume (Cu. ft) = 3.14 X Radius (ft) X Radius (ft) X Depth (ft)

PIPE VOLUME: .785 X Diameter ^{2} X Length = ? To obtain gallons multiply by 7.48

SPHERE: $\frac{(3.14)\ (\text{Diameter})^3}{(6)}$

Circumference = 3.14 X Diameter

General Conversions

Flowrate

Multiply	—>	to get
to get	**<—**	**Divide**
cc/min	1	mL/min
cfm (ft^3/min)	28.31	L/min
cfm (ft^3/min)	1.699	m^3/hr
cfh (ft^3/hr)	472	mL/min
cfh (ft^3/hr)	0.125	GPM
GPH	63.1	mL/min
GPH	0.134	cfh
GPM	0.227	m^3/hr
GPM	3.785	L/min
oz/min	29.57	mL/min

POUNDS PER DAY= Concentration (mg/L) X Flow (MG) X 8.34
***A.K.A.* Solids Applied Formula** = Flow X Dose X 8.34

PERCENT EFFICIENCY = $\frac{\text{In} - \text{Out}}{\text{In}} \times 100$

TEMPERATURE: $^0F = (^0C \times 9/5) + 32$ 9/5 =1.8
$^0C = (^0F - 32) \times 5/9$ 5/9 = .555

CONCENTRATION: Conc. (A) X Volume (A) = Conc. (B) X Volume (B)

FLOW RATE (Q): Q = A X V (**Q**uantity = **A**rea X **V**elocity)

FLOW RATE (gpm): Flow Rate (gpm) = $\frac{2.83\ (\text{Diameter, in})^2\ (\text{Distance, in})}{\text{Height, in}}$

% SLOPE = $\frac{\text{Rise (feet)}}{\text{Run (feet)}} \times 100$

ACTUAL LEAKAGE = $\frac{\text{Leak Rate (GPD)}}{\text{Length (mi.)} \times \text{Diameter (in)}}$

VELOCITY = $\frac{\text{Distance (ft)}}{\text{Time (Sec)}}$

N = Manning's Coefficient of Roughness
R = Hydraulic Radius (ft.)
S = Slope of Sewer (ft/ft.)

HYDRAULIC RADIUS (ft) = $\frac{\text{Cross Sectional Area of Flow (ft)}}{\text{Wetted pipe Perimeter (ft)}}$

WATER HORSEPOWER = $\frac{\text{Flow (gpm)} \times \text{Head (ft)}}{3960}$

BRAKE HORSEPOWER = $\frac{\text{Flow (gpm)} \times \text{Head (ft)}}{3960 \times \text{Pump Efficiency}}$

MOTOR HORSEPOWER = $\frac{\text{Flow (gpm)} \times \text{Head (ft)}}{3960 \times \text{Pump Eff.} \times \text{Motor Eff.}}$

MEAN OR AVERAGE = $\frac{\text{Sum of the Values}}{\text{Number of Values}}$

TOTAL HEAD (ft) = Suction Lift (ft) X Discharge Head (ft)

SURFACE LOADING RATE (gal/min/sq.ft) = $\frac{\text{Flow Rate (gpm)}}{\text{Surface Area (sq. ft)}}$

MIXTURE STRENGTH (%) = $\frac{(\text{Volume 1, gal})(\text{Strength 1, \%}) + (\text{Volume 2, gal})(\text{Strength 2,\%})}{(\text{Volume 1, gal}) + (\text{Volume 2, gal})}$

INJURY FREQUENCY RATE = $\frac{(\text{Number of Injuries})\ 1{,}000{,}000}{\text{Number of hours worked per year}}$

DETENTION TIME (hrs) = $\frac{\text{Volume of Basin (gals)} \times 24\ \text{hrs}}{\text{Flow (GPD)}}$

SLOPE = $\frac{\text{Rise (ft)}}{\text{Run (ft)}}$

SLOPE (%) = $\frac{\text{Rise (ft) X 100}}{\text{Run (ft)}}$

POPULATION EQUIVALENT (PE):

1 PE = .17 Pounds of BOD per Day
1 PE = .20 Pounds of Solids per Day
1 PE = 100 Gallons per Day

LEAKAGE (GPD/inch) = $\frac{\text{Leakage of Water per Day (GPD)}}{\text{Sewer Diameter (inch)}}$

CHLORINE DEMAND (mg/L) = Chlorine Dose (mg/L) – Chlorine Residual (mg/L)

MANNING FORMULA

τQ = Allowable time for decrease in pressure from 3.5 PSI to 2.5 PSI
τq = As below

$\tau Q = (0.022)\,(d_1^2L_1)/Q \quad \tau q = \frac{[\,0.085]}{q}\,[(d_1^2L1)/(d_1L_1)]$

Q = 2.0 cfm air loss
θ = .0030 cfm air loss per square foot of internal pipe surface
δ = Pipe diameter (inches)
L = Pipe Length (feet)

$V = \frac{1.486}{\nu} R^{2/3} S^{1/2}$

V = Velocity (ft./sec.)
ν = Pipe Roughness
R = Hydraulic Radius (ft)
S= Slope (ft/ft)

HYDRAULIC RADIUS (ft) = $\frac{\text{Flow Area (ft. 2)}}{\text{Wetted Perimeter (ft.)}}$

WIDTH OF TRENCH (ft) = Base (ft) + (2 Sides) X $\frac{\text{Depth (ft 2)}}{\text{Slope}}$

Formula/Conversion Table

Acid Feed Rate = $\frac{\text{(Waste Flow) (Waste Normality)}}{\text{Acid Normality}}$

Alkalinity = $\frac{\text{(mL of Titrant) (Acid Normality) (50,000)}}{\text{mL of Sample}}$

Amperage = Voltage ÷ Ohms

Area of Circle = (0.785)(Diameter2) OR (π)(Radius2)

Area of Rectangle = (Length)(Width)

Area of Triangle = $\frac{\text{(Base) (Height)}}{2}$

C Factor Slope = Energy loss, ft. ÷ Distance, ft.

C Factor Calculation = Flow, GPM ÷ [193.75 (Diameter, ft.)2.63(Slope)0.54]

Chemical Feed Pump Setting, % Stroke = $\frac{\text{(Desired Flow) (100\%)}}{\text{Maximum Flow}}$

Chemical Feed Pump Setting, mL/min =
$\frac{\text{(Flow, MGD) Dose, mg/L) (3.785L/gal) (1,000,000 gal/MG)}}{\text{(Liquid, mg/mL) (24 hr. / day) (60 min/hr.)}}$

Chlorine Demand (mg/L) = Chlorine dose (mg/L) – Chlorine residual (mg/L)

Circumference of Circle = (3.141) (Diameter)

Composite Sample Single Portion = $\frac{\text{(Instantaneous Flow) (Total Sample Volume)}}{\text{(Number of Portions) (Average Flow)}}$

Detention Time = $\frac{\text{Volume}}{\text{Flow}}$

Digested Sludge Remaining, % = $\frac{\text{(Raw Dry Solids) (Ash Solids) (100\%)}}{\text{(Digested Dry Solids) (Digested Ash Solids)}}$

Discharge = $\frac{\text{Volume}}{\text{Time}}$

Dosage, lbs/day = (mg/L)(8.34)(MGD)
Dry Polymer (lbs.) = (gal. of solution) (8.34 lbs/gal)(% polymer solution)

Efficiency, % = $\frac{\text{(In – Out) (100\%)}}{\text{In}}$

$$\text{Feed rate, lbs/day} = \frac{(\text{Dosage, mg/L})\ (\text{Capacity, MGD})\ (8.34\ \text{lbs/gals})}{(\text{Available fluoride ion})\ (\text{Purity})}$$

$$\text{Feed rate, gal/min (Saturator)} = \frac{(\text{Plant capacity, gal/min.})\ (\text{Dosage, mg /L})}{18{,}000\ \text{mg/L}}$$

$$\text{Filter Backwash Rate} = \frac{\text{Flow}}{\text{Filter Area}}$$

$$\text{Filter Yield, lbs/hr./sq. ft} = \frac{(\text{Solids Loading, lbs/day})\ (\text{Recovery, \% / 100\%})}{(\text{Filter operation, hr./day})\ (\text{Area, ft2})}$$

Flow, cu. ft./sec. = (Area, Sq. Ft.)(Velocity, ft./sec.)

$$\text{Gallons/Capita/Day} = \frac{\text{Gallons / day}}{\text{Population}}$$

$$\text{Hardness} = \frac{(\text{mL of Titrant})\ (1{,}000)}{\text{mL of Sample}}$$

$$\text{Horsepower (brake)} = \frac{(\text{Flow, gpm})\ (\text{Head, ft})}{(3{,}960)\ (\text{Efficiency})}$$

$$\text{Horsepower (motor)} = \frac{(\text{Flow, gpm})\ (\text{Head, ft})}{(3960)\ (\text{Pump, Eff})\ (\text{Motor, Eff})}$$

$$\text{Horsepower (water)} = \frac{(\text{Flow, gpm})\ (\text{Head, ft})}{(3960)}$$

$$\text{Hydraulic Loading Rate} = \frac{\text{Flow}}{\text{Area}}$$

Leakage (actual) = Leak rate (GPD) ÷ [Length (mi.) x Diameter (in.)]

Mean = Sum of values ÷ total number of values

$$\text{Mean Cell Residence Time (MCRT)} = \frac{\text{Suspended Solids in Aeration System, lbs}}{\text{SS Wasted, lbs / day + SS lost, lbs / day}}$$

$$\text{Organic Loading Rate} = \frac{\text{Organic Load, lbs BOD / day}}{\text{Volume}}$$

$$\text{Oxygen Uptake} = \frac{\text{Oxygen Usage}}{\text{Time}}$$

Pounds per day = (Flow, MGD) (Dose, mg/L) (8.34)

$$\text{Population Equivalent} = \frac{(\text{Flow MGD})\ (\text{BOD, mg/L})\ (8.34\ \text{lbs / gal})}{\text{Lbs BOD / day / person}}$$

$$\text{RAS Suspended Solids, mg/l} = \frac{1{,}000{,}000}{\text{SVI}}$$

$$\text{RAS Flow, MGD} = \frac{(\text{Infl. Flow, MGD})(\text{MLSS, mg/l})}{\text{RAS Susp. Sol., mg/l} - \text{MLSS, mg/l}}$$

$$\text{RAS Flow \%} = \frac{(\text{RAS Flow, MGD})(100\ \%)}{\text{Infl. Flow, MGD}}$$

$$\text{Reduction in Flow, \%} = \frac{(\text{Original Flow} - \text{Reduced Flow})(100\%)}{\text{Original Flow}}$$

$$\text{Slope} = \frac{\text{Drop or Rise}}{\text{Run or Distance}}$$

$$\text{Sludge Age} = \frac{\text{Mixed Liquor Solids, lbs}}{\text{Primary Effluent Solids, lbs / day}}$$

$$\text{Sludge Index} = \frac{\text{\% Settleable Solids}}{\text{\% Suspended Solids}}$$

$$\text{Sludge Volume Index} = \frac{(\text{Settleable Solids, \%})(10{,}000)}{\text{MLSS, mg/L}}$$

$$\text{Solids, mg/L} = \frac{(\text{Dry Solids, grams})(1{,}000{,}000)}{\text{mL of Sample}}$$

Solids Applied, lbs/day = (Flow, MGD)(Concentration, mg/L)(8.34 lbs/gal)

$$\text{Solids Concentration} = \frac{\text{Weight}}{\text{Volume}}$$

$$\text{Solids Loading, lbs/day/sq. ft} = \frac{\text{Solids Applied, lbs / day}}{\text{Surface Area, sq. ft}}$$

$$\text{Surface Loading Rate} = \frac{\text{Flow}}{\text{Rate}}$$

Total suspended solids (TSS), mg/L =
(Dry weight, mg)(1,000 mL/L) ÷ (Sample vol., mL)

$$\text{Velocity} = \frac{\text{Flow}}{\text{Area}} \quad \text{O R} \quad \frac{\text{Distance}}{\text{Time}}$$

$$\text{Volatile Solids, \%} = \frac{(\text{Dry Solids} - \text{Ash Solids})(100\%)}{\text{Dry Solids}}$$

Volume of Cone = (1/3)(0.785)(Diameter2)(Height)

Volume of Cylinder = (0.785)(Diameter2)(Height) OR (π)(r2)(h)

Volume of Rectangle = (Length)(Width)(Height)

Volume of Sphere = [(π)(diameter3)] ÷ 6

Waste Milliequivalent = (mL) (Normality)

Waste Normality = $\frac{\text{(Titrant Volume) (Titrant Normality)}}{\text{Sample Volume}}$

Weir Overflow Rate = $\frac{\text{Flow}}{\text{Weir Length}}$

Conversion Factors

1 acre = 43,560 square feet
1 cubic foot = 7.48 gallons
1 foot = 0.305 meters
1 gallon = 3.785 liters
1 gallon = 8.34 pounds
1 grain per gallon = 17.1 mg/L
1 horsepower = 0.746 kilowatts
1 million gallons per day = 694.45 gallons per minute
1 pound = 0.454 kilograms
1 pound per square inch = 2.31 feet of water
1% = 10,000 mg/L
Degrees Celsius = (Degrees Fahrenheit - 32) (5/9)
Degrees Fahrenheit = (Degrees Celsius * 9/5) + 32
64.7 grains = 1 cubic foot
1,000 meters = 1 kilometer
1,000 grams = 1 kilogram

Post Quiz Answers

Topic -1 Pretreatment Overview Answers
1. Sewer system, 2. Overflow(s), 3. Food Service Establishments (FSEs),4. POTW Commercial FOG Program, 5. True, 6. POTW's sewer system, 7. Grease, 8. Law, 9. FOG, 10. Greater expenditures, 11. Sewer backup(s), 12. FSEs, 13. Yellow grease and grease trap waste, 14. Tallow, 15. FOG material, 16. POTW collection system(s), 17. True, 18. Untreated wastewater, 19. Control and capture the FOG, 20. Interceptor/collector device(s)

Topic 2 - Pretreatment Program Development Answers
1. True, 2. True, 3. True, 4. False, 5. False, 6. False, 7. True, 8. False, 9. False, 10. True, 11. False, 12. True, 13. False, 14. True, 15. True, 16. False, 17. True, 18. True, 19. False, 20. False

Topic 3 - Identifying Industrial Users Answers
1. Control Authorities, 2. An extra jurisdictional IU, 3. POTW, 4. Control Authorities, 5. SIU(s), 6. SIU's discharge, 7. Potential permittees, 8. Issuing permits, 9. General control mechanisms, 10. Control Authority, 11. Permit program, 12. POTW, 13. Permit applicants, 14. Industrial Users, 15. Control Authority, 16. SIU, 17. Permittee, 18. Control Authority, 19. Control Authority, 20. Control Authority

Topic 4- Permit Applications Answers
1. Permit, 2. Reissued permit, 3. Existing BMPs, 4. Plumbing schematics, 5. Wastestream, 6. Appropriate permit conditions, 7. Industrial User's BMR, 8. Application, 9. Multiple attachments, 10. Cooling water, 11. All raw materials, 12. Toxic or nonconventional pollutants, 13. Wastestream, 14. Toxic substances ,15. Material safety data sheets, 16. Categorical standards, 17. Correct effluent limits, 18. Piping diagrams, 19. Water balance, 20. BMPs

Topic 5 - Permitting Considerations Answers
1. True, 2.True, 3. False, 4. False, 5. True, 6. False, 7. True, 8. True, 9. False, 10. True 11. True, 12. False, 13. False, 14. False, 15. True, 16. True, 17. False, 18. False, 19. True, 20. True

Topic 6 - Effluent Limitations Answers
1. Treatment practices for pollution control, 2. Effluent limits, 3. Effluent limitations for the pollutants, 4. Categorically-regulated wastestream, 5. Monthly average categorical, 6. Categorical Pretreatment Standards, 7. Special considerations, 8. Flow and concentration, 9. Wastestream flow, 10. Monthly average limits, 11. Legal document, 12. Long-term production rate, 13. Water conservation methods, 14. Dilution, 15. Continuous effluent flow monitoring device, 16. Discharge, 17. Dilution as a substitute for treatment, 18. Pollutants, 19. Discharges, 20. Pollutant concentration

Topic 7- Monitoring and Reporting Requirements Answers
1. Pretreatment Requirements, 2. Categorical Pretreatment Standards, 3. Baseline Monitoring Report (BMR), 4. Combined Wastestream Formula (CWF), 5. Chronic, 6. Regulated Wastestream, 7. Chain of Custody (COC), 8. Concentration-based Limit, 9. General Prohibitions, 10. Grab Sample, 11. Bypass, 12. Categorical Industrial User (CIU), 13. Combined Sewer Overflow (CSO), 14. Approval Authority, 15. Pretreatment, 16. Composite Sample, 17. Non-Regulated Wastestream, 18. Industrial User (IU), 19. Nonconventional Pollutants, 20. Non-Contact Cooling Water

Topic 8- Pretreatment and Wastewater Sampling Overview Answers
1. Primary pH standard values, 2. 7, 3. Hydronium ion concentration, 4. Measurement of pH, 5. A dimensionless quantity, 6. Alkalinity, 7. Hydrogen ion activity, 8. Acid, 9. Visual comparison, 10. Nature of the solution, 11. The concentration value, 12. End-point pH, 13. Solution of a cubic equation, 14. An aggregate property of water, 15. Colorimeter of spectrophotometer, 16. The solution of a quadratic equation, 17. Chemical speciation, 18. Alkalinity, 19. Strong acids and bases, 20. Strong base

Topic 9 - Standard and Special Conditions Answers
1. Control Authority's discretion, 2. Free of legal loopholes, 3. Standard conditions, 4. Effluent data and upset, 5. General discharge prohibitions, 6. Violation of applicable federal Pretreatment Standards, 7. Control Authority, 8. To take all reasonable measures, 9. An Industrial User's permit, 10. Any property rights, 11. Compliance with the conditions of the permit, 12. Falsification or misrepresentation of information, 13. The Industrial User, 14. Right of appeal, 15. Revoked by a court of law, 16. The Industrial User's responsibility, 17. Wastewater treatment facilities, 18. Dilution of Industrial User wastewaters, 19. Sampling events, 20. EPA-approved sampling methods

Topic 10 – Enforcement Post Quiz
1. IU noncompliance, 2. ERP, 3. Discharge permit limit exceedances, 4. IU compliance, 5. Civil or criminal penalties, 6. Criminal violations, 7. Noncompliance, 8. Unresolved IU noncompliance, 9. Pretreatment program reports, 10. A court order, 11. Stronger enforcement mechanisms, 12. Cease and Desist Order, 13. Noncompliance and to deter future violations, 14. Penalties for violations, 15. Chronic violations, 16. True, 17. Interference or pass through, 18. Attaining final compliance, 19. Imminent endangerment to human health, 20. Any other violation or group of violations

Topic 11 - POTW Hauled & Hazardous Wastes Requirements
1. Hauled hazardous waste, 2. Domestic sewage, 3. Hauled hazardous waste, 4. Hauled process wastes, 5. Hauled waste(s), 6. True, 7. Non-hazardous waste(s), 8. Hazardous waste, 9. Pollutants, 10. Sewage or domestic waste, 11. Domestic septage 12. Effectiveness of treatment on this waste, 13. Adequacy of local limits, 14. Daily flow limitations, 15. Hauled waste, 16. Concentration of discharges, 17. All loads of hauled waste, 18. Waste has not impacted the POTW, 19. The frequency of sampling, 20. Manifests

Topic 12 – Confined Space Answers
1. Bodily enter and perform work, 2. Entry or exit, 3. Continuous employee occupancy, 4. Hazardous atmosphere, 5. An entrant, 6. Health hazard, 7. Permit-Required Confined Space, 8. Confined spaces, 9. Induced hazards, 10. Inherent hazards, 11. Defective design, 12. Hazard control methods, 13. Induced hazards, 14. Flammable atmospheres, 15. Both inherent and induced hazards, 16. A variety of vaults, 17. Below-grade location, 18. An oxygen-deficient atmosphere, 19. Serious hazards, 20. A variety of hazards

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Guidance Manual For Implementing Total Toxic Organics (TTO) Pretreatment Standards

Guidance Manual for Preparation and Review of Removal Credit Applications

Guidance Manual for Preventing Interference at POTWs

Guidance Manual for the Identification of Hazardous Wastes Delivered to Publicly Owned Treatment Works by Truck, Rail, or Dedicated Pipe

Guidance Manual for the Use of Production-Based Pretreatment Standards and the Combined Wastestream Formula

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Model Pretreatment Ordinance

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Pretreatment Compliance Monitoring and Enforcement Guidance

RCRA Information on Hazardous Wastes for Publicly Owned Treatment Works

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