United States
Environmental Protection
Agency

Office of Water
Enforcement and Permits (EN-338)
Washington, D.C. 20460

MAY 1988

Water

EPA

NPDES Compliance Inspection Manual

NPDES COMPLIANCE INSPECTION MANUAL

May 1988

U.S. Environmental Protection Agency
Office of Water
Office of Water Enforcement and Permits
(EN-338)
401 M Street, SW
Washington, DC 20460

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

MEMORANDUM

OFFICE OF WATER

SUBJECT: NPDES Compliance Inspection Manual

FROM: James R. Elder, Director
Office of Water Enforcement and Permits

TO: Users of the NPDES Compliance Inspection Manual

This manual is the first update of the June 1984 NPDES Compliance Inspection Manual. The modifications include recent changes to the regulations and citations, a new emphasis on biomonitoring, and clarification on pretreatment inspections. The manual, as revised and in the original text, provides discussion on all major compliance inspection functions (i.e. sampling, flow measurement, etc.) and does not focus on any one inspection type (i.e. compliance evaluation or compliance sampling inspection). This approach allows the inspector to refer to specific chapters and checklists when engaging in a particular activity which is part of an NPDES inspection.

The inspector's primary objective is to gather information and report facts. In order to meet this objective he/she must have a clear understanding of the technical information necessary to evaluate compliance and an understanding of the regulations and NPDES program requirements. This manual will provide the basic information to enable inspectors to focus their efforts properly, thereby improving the effectiveness of the inspections.

I believe that this manual will provide valuable assistance to inspectors, for successful completion of their very important duties. Please feel free to write to the Office of Water Enforcement and Permits (EN-338) with suggestions, additions or improvements to this manual.

ACKNOWLEDGMENTS

We acknowledge the considerable efforts and cooperation of the many people whose contributions helped successfully complete this document.

This manual was prepared under the direction of Gary Polvi with assistance from Virginia Lathrop of OWEP, and the Inspection Materials Work Group including Robert Reeves, Region 6; Joseph Slayton, Region 3 Central Regional Lab; Gary Bryant, Region 3 Wheeling Office; William Peltier, EPA Region 4 EPA; Dan Tangerone, Region 10; Dan Murray, EPA Region 1; Charles Moses and Jack Wolfe of the West Virginia Division of Water Resources; Ted Denning of Illinois EPA; and Alton Boozer of South Carolina Department of Health and Environmental Control. Extensive reviews were conducted by EPA Headquarters, Regional Offices, and many State agencies during the initial development and 1987 update. These reviews provided valuable comments, most of which were incorporated into this manual.

This manual was prepared by SRA Technologies, Inc., under EPA Contract No. 68-01-6514, and revised by SAIC under EPA Contract No. 68-01-7050.

DISCLAIMER

This manual has been reviewed by the Office of Water Enforcement and Permits, U.S. Environmental Protection Agency, and approved for publication. This guidance represents EPA's recommended procedures for conducting NPDES compliance inspections only. Failure on the part of any duly authorized official, inspector or agent to comply with its contents shall not be a defense in any enforcement action, nor shall a failure to comply with this guidance alone constitute grounds for rendering evidence obtained thereby, inadmissible in a court of law. The mention of trade names or commercial products constitutes neither endorsement nor recommendation for use.

FOREWORD

The National Pollutant Discharge Elimination System (NPDES) Compliance Inspection Manual has been developed to support inspection personnel in conducting field investigations fundamental to the NPDES compliance program and to provide inspectors with standardized procedures for conducting complete, accurate inspections.

The information presented in this manual will guide a qualified inspector in conducting an accurate inspection. The manual presents standard procedures for inspection; it is assumed the inspector has a working knowledge of wastewater and related problems, regulations, and control technologies. The manual will serve the experienced inspector as a flexible and easy reference. New inspection personnel will find support in the orderly and detailed presentation of the material.

This manual presents the most current information on NPDES compliance inspections available at the time of publication. As new information concerning inspection protocols and policies emerges, the manual will be revised accordingly. Comments or changes to the present manual should be addressed to:

Chief, Enforcement Support Branch (EN-338)
Office of Water Enforcement and Permits
U.S. Environmental Protection Agency
401 M Street, SW
Washington, DC 20460

The information contained in this manual is comprehensive and designed to address a wide range of activities. Since each inspection may not involve all activities, the inspector should refer to those parts applicable to the particular inspection. Although the information is presented from the viewpoint of the Environmental Protection Agency (EPA), it is applicable to NPDES State inspectors and other regulatory authorities or their authorized representatives. In particular, the Minerals Management Service may find the manual useful for coordinating the EPA NPDES permit compliance program with the Minerals Management Service Offshore Inspection Program.

This NPDES Compliance Inspection Manual consolidates information found in previous inspection manuals. Although the earlier manuals are generally still accurate and in some cases even cover technical issues in more detail, they are organized by inspection type and may contradict this manual on a few issues. Previous manuals do not reflect updated policy and

strategies. These previous manuals should be retained as technical references, but in the event of contradictions, this manual takes preference.

The manual is organized into nine chapters:

- Chapter One, "Introduction," describes the NPDES program and provides general information relating to legal authority and inspector responsibilities.

- Chapter Two, "Inspection Procedures," discusses general procedures common to all NPDES inspections, including pre-inspection preparation, entry, opening conference, documentation, closing conference, and inspection report.

- Chapters Three through Nine provide the specific technical information necessary to conduct the full range of NPDES compliance inspection activities. Each chapter describes procedures for the major technical activities involved in compliance inspections:

  - Chapter Three, "Recordkeeping and Reporting"
  - Chapter Four, "Facility Site Review"
  - Chapter Five, "Sampling"
  - Chapter Six, "Flow Measurement"
  - Chapter Seven, "Biomonitoring"
  - Chapter Eight, "Laboratory Quality Assurance"
  - Chapter Nine, "Pretreatment."

Within each chapter, tables and figures illustrate the topics discussed in the text. These are located at the end of the chapter subsection in which they are referenced. As appropriate, references and checklists are provided at the end of the chapter. The checklists presented in this manual are intended as guidance. They may be used as presented or modified to address the needs of the inspection authority. More detailed checklists for any individual inspection type may have also been developed by EPA and presented in the guidance materials specific to that type of inspection.

It should be noted that the text often is written from the perspective of the Federal Clean Water Act requirements. State NPDES inspectors using this manual may find that State rules and procedures on such topics as notice to the permittees may vary to some degree from the material found in this manual. The technical material will, we hope, prove to be useful to all NPDES inspectors.

Inspection Types

This manual provides guidance applicable to each type of inspection a NPDES inspector may be required to conduct at a wastewater facility. These different types of inspections are described below.

Compliance Evaluation Inspection (CEI)

The CEI is a nonsampling inspection designed to verify permittee compliance with applicable permit self-monitoring requirements and compliance schedules. This inspection involves record reviews, visual observations, and evaluations of the treatment facilities, effluents, receiving waters, etc. The CEI examines both chemical and biological self-monitoring and forms the basis for all other inspection types except the Reconnaissance Inspection.

Compliance Sampling Inspection (CSI)

During the CSI, representative samples required by the permit are obtained. Chemical analyses are performed and the results are used to: verify the accuracy of the permittee's self-monitoring program and reports; determine the quantity and quality of effluents; develop permits; and provide evidence for enforcement proceedings where appropriate. In addition, the CSI includes the same objectives and tasks as a CEI.

Toxics Sampling Inspection (XSI)

The XSI has the same objectives as a conventional CSI. However, it places increased emphasis on toxic substances regulated by the NPDES permit. The XSI covers priority pollutants other than heavy metals, phenols, and cyanide, which are typically included in a CSI. An XSI uses more resources than a CSI because highly sophisticated techniques are required to sample and analyze toxic pollutants.

Compliance Biomonitoring Inspection (CBI)

The CBI uses acute and chronic toxicity testing techniques to evaluate the biological effect of a permittee's effluent discharge(s) on test organisms. In addition, this inspection includes the same objectives and tasks as a CEI.

Performance Audit Inspection (PAI)

The PAI is used to evaluate the permittee's self-monitoring program. As with a CEI, the PAI is used to verify the permittee's reported data and compliance through a records check. In a CEI, the inspector makes a cursory visual observation of the treatment facility, effluents, and receiving waters. In a PAI, the inspector actually observes the permittee performing the self-monitoring process from sample collection and flow measurement through laboratory analyses, data workup, and reporting. The PAI inspector may leave a check sample for the permittee to analyze. Compared to a CSI, the PAI is less resource intensive because sample collection and analyses by EPA or the State are not included.

Diagnostic Inspection (DI)

The DI primarily focuses on Publicly Owned Treatment Works (POTWs) that have not achieved permit compliance. POTWs who are having difficulty diagnosing their problems are targeted. The purposes of the DI are to identify the causes of noncompliance and to suggest immediate remedies that will help the POTW achieve compliance. Once the cause of noncompliance is defined, an administrative order is usually issued that requires the permittee to conduct a detailed analysis and develop a composite correction plan.

Pretreatment Compliance Inspection (PCI)

The PCI evaluates the POTW's implementation of its approved pretreatment program. It includes a review of the POTW's records on monitoring, inspections, and enforcement activities for its industrial users (IUs). The PCI may be supplemented with IU inspections. An IU inspection is an inspection of any significant IU which discharges to the POTW. The inspection can be either a facility or sampling inspection, or both. The PCI should be conducted concurrently with another NPDES inspection of the POTW.

It should be noted that a related type of review procedure, the pretreatment audit, is also performed by Approval Authorities. The pretreatment audit is not treated in depth in this manual because it is not regarded as a true NPDES compliance inspection. The pretreatment audit is defined and discussed in Section 1.2, page 1.1, of the U.S. EPA guidance manual Pretreatment Compliance Inspection and Audit Manual for Approval Authorities (July, 1986).

Reconnaissance Inspection (RI)

The RI is used to obtain a preliminary overview of a permittee's compliance program. The inspector performs a brief visual inspection of the permittee's treatment facility, effluents, and receiving waters. The RI uses the inspector's experience and judgment to summarize quickly any potential compliance problems. The objective of the RI is to expand inspection coverage without increasing inspection resources. The RI is the briefest of all NPDES inspections.

Legal Support Inspection (LSI)

The LSI is a resource intensive inspection conducted when an enforcement problem is identified as a result of a routine inspection or a complaint. For an LSI, the appropriate resources are assembled to deal effectively with a specific enforcement problem.

Summary

Table F-1 matches minimum inspection activities with each of the inspection types. The given activities are only minimum requirements and an inspector is not limited to the stated activities; additional activities may be conducted depending upon the focus of the inspection.

The inspector should plan all activities and coordinate with compliance personnel before the inspection. The minimum requirements may serve as a basis for deciding what activities will be conducted on-site and for determining what additional information is to be gathered or verified during the inspection. Compliance personnel should choose the type of inspection to be conducted based on: the compliance status of the facility, the information needed from the facility, and the type of facility involved (e.g., toxic organic effluents, Federally funded, etc.).

Table F-1

Comparison of Inspection Activities With Inspection Types

ACTIVITY DESCRIPTION	Page No.	INSPECTION TYPES CEI	CSI	PAI	CBI	XSI	DI	RI	PCI*
PRE-INSPECTION									
Review Facility Background	2-1	I	I	I	I	I	I	I	I
Develop an Inspection Plan	2-4	0	I	0	I	I	0	0	0
Notification of the Facility	2-5	0	0	0	0	0	0	0	0
ENTRY ONSITE									
Entry Procedures	2-11	I	I	I	I	I	I	I	I
Opening Conference	2-15	C	C	C	C	C	C	C	C
RECORDKEEPING AND REPORTING									
Permit Information Verification	3-3	I	I	I	C	I	I	0	0
Evaluation Procedures	3-3	I	I	I	C	I	I	C	C
Compliance Schedule Status Review	3-5	C	C	C	-	C	C	0	0
Pretreatment Record Review	3-7	C	C	C	-	C	C	-	I
FACILITY SITE REVIEW									
Physical Inspection	4-3	C	C	C	C	C	I	C	0
Operation Evaluation	4-13	C	C	C	C	C	I	C	0
Maintenance Evaluation	4-14	C	C	C	C	C	I	C	-
SAMPLING									
Evaluation of Permittee Program	5-1	I	I	I	0	I	I	C	C
Inspector's Compliance Sampling	5-3	-	I	-	I	I	0	-	0
FLOW MEASUREMENT									
Evaluation of Permittee Flow Measurement	6-1	C	I	I	I	I	I	C	0
Verification of Flow Measurements	6-35	C	I	C	C	C	I	C	C
BIOMONITORING									
Evaluation of Permittee Self-Monitoring Program	7-1	C	C	I	I	C	C	-	-
Compliance Biomonitoring	7-9	-	-	-	I	-	-	-	-
LABORATORY QUALITY ASSURANCE									
Sampling Techniques Evaluation	8-3	C	C	I	C	C	C	C	0
Analyses Techniques Evaluation	8-5	C	C	I	C	C	C	C	0
Laboratory Quality Assurance	8-9	C	C	I	C	C	C	C	0

Table F-1

Comparison of Inspection Activities With Inspection Types
(Continued)

		INSPECTION TYPES							
ACTIVITY DESCRIPTION	Page No.	CEI	CSI	PAI	CBI	XSI	DI	RI	PCI*
OTHER SITE ACTIVITIES									
Inspection of Industrial Discharges to POTWs	-	-	-	-	-	-	-	-	0
Documentation of Hazardous Waste Storage and Disposal	-	0	0	0	0	0	0	0	0
Documentation of Air Pollution Releases	-	0	0	0	0	0	0	0	0
Sludge Management Issues	-	0	0	0	0	0	0	0	0
DOCUMENTATION									
Field Notes and Statements	2-19	I	I	I	I	I	I	I	I
Photographs, Drawings, and Maps	2-21	0	C	0	0	0	I	C	0
Copies of Facility Records	2-24	0	0	0	0	0	I	0	I
CLOSING PROCEDURES									
Closing Conference	2-29	C	C	I	C	C	I	C	C
Notice of Deficiency	2-29	C	C	I	C	C	I	C	C
FOLLOW-UP									
Inspection Form	2-33	I	I	I	I	I	I	I	I
Narrative Comments/Checklists	2-34	I	I	I	I	I	I	I	I
Input on PCS	2-35	I	I	I	I	I	I	I	I

LEGEND
I - Activity is conducted in an indepth manner
C - Activity is conducted in a cursory manner
0 - Activity is optional, but may be recommended by Regional or State policy

*The PCI has been developed to verify compliance status of the POTW and focuses primarily on the compliance monitoring and enforcement activities of the POTW. Inspections of indirect industrial facilities to verify their compliance with applicable pretreatment standards is not addressed in the description of activities listed for the PCI.

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LIST OF ACRONYMS

Acronym	Full Phrase
BCT/BAT	Best Control Technology/Best Available Technology
BMP	Best Management Practices
BOD_5	Biochemical Oxygen Demand
CAA	Clean Air Act
CBI	Compliance Biomonitoring Inspection
CEI	Compliance Evaluation Inspection
CERCLA	Comprehensive Environmental Response, Compensation, and Liability Act
CFR	Code of Federal Regulations
CSI	Compliance Sampling Inspection
CWA	Clean Water Act
CWF	Combined Wastestream Formula
DI	Diagnostic Inspection
DMR	Discharge Monitoring Report
DO	Dissolved Oxygen
EC50	Concentration which causes an effect in 50% of the test organisms
EMSL	EPA Environmental Monitoring System Laboratory
EPA	Environmental Protection Agency
FIFRA	Federal Insecticide, Fungicide and Rodenticide Act
FR	Federal Register
GC	Gas Chromotography
GC/MS	Gas Chromotography/Mass Spectroscopy
IWC	Instream Waste Concentration
LC	Lethal Concentration
LC50	Concentration at which 50% of the test organisms die in a specified time period
LD50	Dose at which 50% of the test organisms die in a specific time period
LOEC	Lowest-Observed-Effect-Concentration
LSI	Legal Support Inspection
MPRSA	Marine Protection, Research, and Sanctuaries Act
NOEL	No-Observed-Effect-Level
NPDES	National Pollutant Discharge Elimination System
O&M	Operation and Maintenance
OSHA	Occupational Safety and Health Administration

LIST OF ACRONYMS (Continued)

Acronym	Full Phrase
PAI	Performance Audit Inspection
PCB	Polychlorinated Biphenyl
PCI	Pretreatment Compliance Inspection
PCS	Permit Compliance System
POTW	Publicly Owned Treatment Works
QA	Quality Assurance
QC	Quality Control
QNCR	Quarterly Noncompliance Report
R&D	Research and Development
RBC	Rotating Biological Contactor
RCRA	Resource Conservation and Recovery Act
RI	Reconnaissance Inspection
SAIC	Science Applications International Corporation
SPCC	Spill Prevention Control and Countermeasure Plan
SRA	Social Research Associates, Inc.
TCDD	Tetrachlorodibenzodioxin
TSCA	Toxic Substances Control Act
TSD	Technical Support Document
TSDF	Treatment, Storage, and Disposal Facility
TSS	Total Suspended Solids
USC	United States Code
USGS	United States Geologic Survey
XSI	Toxics Sampling Inspection

Chapter One

INTRODUCTION

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Chapter One

A LEGAL AUTHORITY FOR NPDES INSPECTIONS

The Federal Water Pollution Control Act of 1972, as amended by the Clean Water Act (CWA or the Act) of 1977 and the Water Quality Act of 1987, gives the Environmental Protection Agency (EPA) the authority to regulate the discharge of pollutants to waters of the United States. The Act provides broadly defined authority to: establish the National Pollutant Discharge Elimination System (NPDES) Permit Program, define pollution control technologies, establish effluent limitations, obtain information through reporting and compliance inspections, and take enforcement actions (both civil and criminal) when violations of the Act occur.

Inspection Authority

Under Section 402 of the Act, dischargers of pollutants are issued permits that set specific limits and operating conditions to be met by the permittee. Section 308 authorizes inspections and monitoring to determine whether NPDES permit conditions are being met. The section provides for two types of monitoring:

- Self-monitoring, where the facility must monitor itself
- EPA monitoring, which may consist of evaluating the self-monitoring or conducting its own monitoring.

According to the Act, EPA may conduct an inspection wherever there is an existing NPDES permit, or where a discharge exists or is likely to exist and no permit has been issued.

State Program Authority

Much of the compliance with the NPDES program is monitored by the State. Sections 308 and 402 of the Act provide for the transfer of Federal program authority to States to conduct NPDES permit compliance monitoring. EPA Regional Administrators and some State water pollution control agencies have signed formal cooperative agreements that ensure timely, accurate monitoring of compliance with permit conditions.

B RESPONSIBILITIES OF THE NPDES INSPECTOR

The primary role of a NPDES inspector is to gather information that can be used to determine compliance with permit conditions, applicable regulations, and other requirements. The NPDES inspector also plays an important role in enforcement case development and support, and in permit development. To fulfill these roles, inspectors are required to know and abide by legal requirements concerning inspections, procedures for effective inspection and evidence collection, accepted safety practices, and quality assurance standards.

Legal Responsibilities

Inspectors must conduct all inspection activities within the legal framework established by the Act, including:

- Presenting proper credentials
- Presenting required notices
- Properly handling confidential business information.

Inspectors also must be familiar with the conditions of the specific permit and with all applicable statutes and regulations.

Procedural Responsibilities

Inspectors must be familiar with general inspection procedures and evidence collection techniques to ensure accurate inspections and to avoid endangering potential legal proceedings on procedural grounds.

Inspection Procedures

Inspectors should observe standard procedures for conducting each inspection element. Responsibilities are illustrated in Table 1-1, given at the end of this section.

Evidence Collection

Inspectors must be familiar with general evidence-gathering techniques. Because the Government's case in a civil or criminal prosecution depends on the evidence they have gathered, inspectors must keep detailed records of each inspection. These data will serve when preparing the inspection report, determining the appropriate enforcement response, and giving testimony in an enforcement case.

In particular, inspectors must know how to:

- Substantiate facts with items of evidence, including samples, photographs, document copies, statements from witnesses, and personal observations
- Evaluate what evidence is necessary (routine inspections)
- Abide by chain-of-custody procedures
- Collect and preserve evidence in a manner that will be incontestable in legal proceedings
- Write clear, objective, and informative inspection reports
- Testify in court and administrative hearings.

Inspection procedures are discussed in detail in Chapter Two of this manual.

Safety Responsibilities

The inspection of wastewater and other environmental pollution control facilities always poses a certain degree of health and safety risk. To avoid unnecessary risks, the inspector should be familiar with all safety guidance and practices and should:

- Use safety equipment in accordance with available guidance and labeling instructions
- Maintain safety equipment in good condition and proper working order
- Dress appropriately for the particular activity and wear appropriate protective clothing
- Use any safety equipment customary in the establishment being inspected (e.g., hard hat or safety glasses).

Procedures to minimize risks during a facility site inspection are discussed in Chapter Four of this manual. For any safety-related questions not covered in this manual, consult the current approved safety manual for greater detail.

Professional Responsibilities

Inspectors are expected to perform their duties with the highest degree of professionalism. Procedures and requirements ensuring ethical actions have been established through many years of Government inspection experience. The procedures and standards of conduct listed below have evolved for the protection of the individual and EPA, as well as industry.

- All investigations are to be conducted within the framework of the United States Constitution and with due regard for individual rights regardless of race, sex, creed, or National origin.
- Inspectors are to conduct themselves at all times in accordance with the regulations prescribing employee responsibilities and conduct.
- The facts of an investigation are to be developed and reported completely, accurately, and objectively.
- In the course of an investigation, any act or failure to act motivated by reason of private gain is illegal. Actions that could be construed as such should be scrupulously avoided.
- A continuing effort should be made to improve professional knowledge and technical skill in the investigative field.

Professional Attitude

The inspector is a representative of EPA and is often the initial or only contact between EPA and the permittees. In dealing with facility representatives and employees, inspectors must be professional, tactful, courteous, and diplomatic. A firm but responsive attitude will encourage cooperation and initiate good working relations. Inspectors should not speak derogatorily of any product, manufacturer, or person.

Attire

Inspectors should dress appropriately, including wearing protective clothing or equipment, for the activity in which they are engaged.

Gifts, Favors, Luncheons

Inspectors should not accept favors or benefits under circumstances that might be construed as influencing the performance of governmental duties. EPA regulations provide an exemption whereby an inspector could accept food and refreshment of nominal value on infrequent occasions in the ordinary course of a luncheon or dinner meeting or other meeting, or during an inspection tour. Inspectors should use this exemption only when absolutely necessary. Employees are not authorized to accept business luncheons; they must pick up their own checks. (See page 20, U.S. EPA Guidance on Ethics and Conflict of Interest, February 1984.)

Requests for Information

EPA has an "open-door" policy on releasing information to the public. This policy is to make information concerning EPA and its work freely and equally available to all interested individuals, groups, and organizations. In fact, EPA employees have both a legal and traditional responsibility for making useful educational and safety information available to the public. This policy, however, does not extend to information about a suspected violation, evidence of possible misconduct, or confidential business information.

Quality Assurance Responsibilities

The inspector must assume primary responsibility for ensuring the quality of compliance inspection data. While other organizational elements play an important role in quality assurance, it is the inspector who must ensure that all data introduced into an inspection file are complete, accurate, and representative of existing conditions. To help the inspector meet this responsibility, Regional Offices have established quality assurance plans that identify individual responsibilities and document detailed procedures.

The objective of a quality assurance plan is to establish standards that will guarantee that inspection data meet the requirements of all users. Many elements of quality assurance plans are incorporated directly into the basic inspection procedures and may not be specifically identified as quality assurance techniques.

The inspector must be aware that following established inspection procedures is critical to the inspection program. These procedures have been developed to reflect the following quality assurance elements:

- Valid data collection
- Approved standard methods
- Control of service, equipment, and supplies
- Quality analytical techniques
- Standard data handling and reporting.

Table 1-1

Responsibilities of the Inspector in the Inspection Process

The elements of the inspection process listed below are common to most NPDES compliance inspections. While the emphasis given to each element may vary among facilities, the inspector's procedural responsibilities remain as listed.

Pre-Inspection Preparation. Ensure effective use of inspection resources.

- Establish purpose and scope of inspection
- Review background information and EPA records, including permit and permittee compliance file
- Contact appropriate staff personnel responsible for the permittee: compliance personnel, pretreatment coordinator, etc.
- Develop plan for inspection
- Prepare documents and equipment
- Coordinate schedule with laboratory if samples are to be collected
- Coordinate schedule with other appropriate regulatory authorities
- Contact party responsible for sample transportation, for packing/shipping requirements.

Entry. Establish legal entry to facility.

- Present official credentials
- Manage denial of entry if necessary.

Opening Conference. Orient facility officials to inspection plan.

- Discuss inspection objectives and scope
- Establish working relationship with facility officials.

Facility Inspection. Determine compliance with permit conditions; collect evidence of violations.

- Conduct visual inspection of facility
- Review facility records
- Inspect monitoring equipment and operations
- Collect samples
- Review laboratory records for QA/QC
- Review laboratory procedures to verify use of approved methods
- Document inspection activities.

Table 1-1

Responsibilities of the Inspector in the Inspection Process
(Continued)

Closing Conference. Conclude inspection.

- Collect missing or additional information
- Clarify questions with facility officials
- Prepare necessary receipts
- Review inspection findings and inform officials of follow-up procedures
- Issue deficiency notice, if appropriate.

Inspection Report. Organize inspection findings into a useful, objective evidence package.

- Complete NPDES Compliance Inspection Report form
- Prepare narrative report, checklists, and documentary information as appropriate.

C MULTIMEDIA CONCERNS IN NPDES PERMITTING AND INSPECTIONS

The NPDES program has made significant progress in controlling point source discharges to surface waters. This progress is measured indirectly, by reduced loadings to surface waters, and directly, by improved water quality. Nevertheless, a need for further improvement to address toxicity problems exists. Effluent toxicity tests and ecological surveys completed by EPA and the States indicate that further controls may be necessary. In addition, NPDES effluent controls may result in transferring residuals from surface waters to other media. This section summarizes additional issues that merit the attention of NPDES program personnel now and in the future.

Surface Water Discharges

As stated above, effluent toxicity tests and ecological surveys completed by EPA and the States indicate that despite the progress that has been made, further controls may be necessary to achieve the "fishable/swimmable" goals of the CWA in certain receiving waters. To this end, EPA issued a policy on the control of toxic pollutants (49 FR 9016) and a comprehensive technical guidance document (Technical Support Document for Water Quality-based Toxics Control, September 1985). The Federal policy and the Technical Support Document (TSD) both recognize that the NPDES program has, for the most part, focused on a limited number of conventional, nonconventional, and priority pollutants. Work conducted by EPA and the States indicates that "nonconventional" pollutants, particularly nonpriority organic pollutants, are a potentially large source of continued effluent toxicity.

The major organics industries discharge greater than one kilogram of nonpriority hazardous constituents for each kilogram of priority constituents. In some cases, the inspector and/or permit writer will be able to identify readily the continued source of toxicity. However, in more complex cases, the pollutant(s) of concern may not be identified readily. The inspector should be aware that the pollutant(s) of concern need not be identified to develop permit limitations, and the TSD does provide recommended procedures for identifying these pollutant(s).

Identifying the specific pollutants of concern can help the inspector focus the inspection plan and tailor any sampling activities. Rather than conducting extensive analytical tests to identify the pollutant(s) present in an effluent, the inspector or permit writer should first review available information on the facility's product process and waste process lines. The review need not be limited to available NPDES information, such as the Form 2C of the NPDES permit application; information on wastes produced and discharged may be available from other sources including information supplied to officials responsible for administering other environmental programs, such as the Resource Conservation and Recovery Act (RCRA).

Many NPDES regulated facilities are also subject to RCRA requirements. RCRA regulates the generation, transportation, treatment, storage, and disposal of hazardous wastes. However, it defers the control of hazardous wastes to the CWA when those wastes are either directly discharged to surface waters (the direct discharge exclusion) or indirectly discharged to a wastewater treatment plant (the domestic sewage exclusion). Whereas many of the 126 priority pollutants are also hazardous constituents, the number of hazardous constituents (383) dwarfs the number of priority pollutants. The discharge of these hazardous constituents should concern the inspectors and operators of wastewater treatment plants.

Hazardous wastes discharged to wastewater treatment plants pass through to surface waters unless incidentally removed in sludge, degraded, or "lost" during the wastewater treatment process through volatilization or exfiltration during treatment. The costs of hazardous waste management using "traditional" storage, treatment and disposal methods are rising significantly as facilities are beginning to comply with the 1984 RCRA Amendments. Consequently, industrial facilities may increasingly use the two previously mentioned exclusions as preferred disposal methods. NPDES permit writers and inspectors may learn whether the facility conducts RCRA regulated activities, and the nature of those activities, from State and/or EPA authorities.

Another source of contaminated wastewaters is hazardous waste clean up actions. Under the RCRA and the Comprehensive Environmental Response and Compensation Liabilities Act (CERCLA), EPA, States, and private parties are initiating clean ups of contaminated sites. Much of the waste found at these sites is liquid, either leachate or contaminated ground water. The treatment, and consequent discharge, of contaminated wastewaters from these sources is expected to increase in the future. These wastes will likely be complex mixtures, requiring a careful examination of their composition to determine appropriate treatment techniques.

Intermedia Transfers Resulting From Wastewater Treatment

It has long been known that wastewater treatment results in the transfer of residuals from wastewater effluents to sludges. Many different statutes and regulations, including the CWA, are charged with management of these sludges. Future NPDES permits will include sludge disposal limitations.

Many States already impose such requirements. NPDES inspectors will need to become more familiar with the relationship between NPDES sludge requirements and those imposed by other statutes and regulations, particularly RCRA, and the Clean Air Act (CAA).

Air emissions from wastewater treatment units are under increasing scrutiny. For organic chemical facilities, EPA is now considering developing wastewater treatment controls which explicitly recognize that treatment processes, such as air stripping, result in the transfer of volatile organics from wastewater effluents to the air. EPA is also considering air emissions from domestic wastewater treatment plants from two perspectives: ambient air quality concerns and a concern for worker health and safety. In another development, the 1984 RCRA amendments provide for the control of air emissions from authorized RCRA treatment, storage, and disposal facilities (TSDFs). As a result, wastewater treatment facilities at RCRA TSDFs are now being investigated by RCRA program personnel. Remedial actions may be required at some of these facilities and the regulatory issue of emissions from wastewater treatment facilities will be addressed.

POTWs receiving hazardous wastes by truck, rail, or dedicated pipeline are subject to RCRA permit by rule requirements. Included among these requirements is the provision that corrective action must be taken to remedy any contamination which may have resulted from a release of hazardous waste or hazardous constituents from solid waste management units, such as surface impoundments, to the environment. For example, if a POTW subject to these RCRA requirements contaminated groundwater through leaching or exfiltration, the permittee might be required to investigate the nature and extent of those releases and, where appropriate, implement corrective measures. Guidance on the nature of these requirements, and how they might affect POTWs, is now being developed.

Summary

The above discussion summarizes coming issues in the NPDES program from a crossmedia perspective. It is apparent from this discussion that several challenges face NPDES inspectors in the future. These challenges represent a developing concept in environmental program management, the "full facility" approach, which requires an understanding of all the potential environmental impacts of a facility's operations and a concommittant attempt to better coordinate regulatory programs to reduce environmental risks. Such an approach can be used during NPDES inspections. If concerns are identified which do not relate to NPDES, the inspector should document the concern and refer it to the proper agency for investigation. For example, worker related concerns should be relayed to the Occupational Safety and Health Administration (OSHA). Any questions on who is the responsible agency should be verified.

Chapter Two

INSPECTION PROCEDURES

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Chapter Two

A PRE-INSPECTION PREPARATION

Pre-planning is necessary to ensure that the inspection is focused properly and is conducted smoothly and efficiently. It involves:

- Review of facility background information
- Development of an inspection plan
- Notification of the facility
- State notification of Federal inspection
- Equipment preparation.

Review of Facility Background Information

Collection and analysis of available background information on the candidate facility are essential to the effective planning and overall success of a compliance inspection. Materials obtained from files of Federal, State, and local agencies, technical libraries, and other information sources will enable inspectors to familiarize themselves with facility operations; conduct a timely inspection; minimize inconvenience to the facility by not requesting data previously provided to the Federal, State, and/or local agencies; conduct a thorough and efficient inspection; clarify technical and legal issues before entry; and develop a sound and factual inspection report. The types of information that may be available for review are listed below. The inspector must determine the amount of background information necessary for the inspection and in collecting this information should focus on the characteristics unique to the permittee: design, historical practices, legal requirements, etc.

General Facility Information

- Maps showing facility location, wastewater discharge pipes, and geographic features
- Names, titles, and telephone numbers of responsible facility officials
- Any special entry requirements

- Nature of processing operations and wastewater
- Production levels--past, present, and future
- Hydrological data
- Geology/hydrogeology of the area
- Changes in facility conditions since previous inspection/permit application
- Available aerial photographs.

Requirements, Regulations, and Limitations

- Copies of Federal, State, and local existing permits, regulations, and requirements
- Restrictions placed on permittee discharges in the form of standards and compliance schedules
- Monitoring and reporting requirements and available monitoring stations
- Special exemptions and waivers, if any
- Receiving stream water quality standards
- Information concerning air, solid, and hazardous waste treatment and disposal.

Facility Compliance and Enforcement History

- Correspondence among facility, local, State, and Federal agencies
- Complaints and reports, follow-up studies, findings, and remedial action
- Documentation on past compliance violations, exceedences, status of requested regulatory corrective action, if any
- Status of current and pending litigation against facility
- Self-monitoring data and reports
- Previous EPA, State, or consultant studies and reports
- Previous deficiency notices issued to facility
- Laboratory capabilities and analytical methods used by the facility
- Previous Discharge Monitoring Report (DMR) - Quality Assurance (QA) files and reports.

Pollution Control and Treatment Systems

- Description and design data for pollution control system and process operation
- Sources and characterization of discharge
- Type and amount of wastes discharged
- Spill prevention contingency plans
- Available bypasses or diversions and spill containment facilities
- Pollution control units, treatment methods, and monitoring systems.

Pretreatment Information

- Information concerning compliance schedule to install pretreatment technologies (industrial facilities) or develop a pretreatment program [Publicly Owned Treatment Works (POTWs)]
- Pretreatment reports as required by the General Pretreatment Regulations, regional, State, or local requirements
- Information concerning industrial discharges to POTWs, such as:

  - Industrial monitoring and reporting requirements
  - POTW monitoring and inspection program
  - Waste contribution to the POTW
  - Compliance status of industry with pretreatment requirements
  - POTW enforcement initiatives.

Sources of Facility Background Information

Other Inspectors. Inspectors who have visited the facility for NPDES or other regulatory programs may have information on the facility.

Laws and Regulations. The Clean Water Act (CWA) and related regulations establish procedures, controls, and other requirements applicable to a facility. In addition, state laws and regulations, and sometimes even local ordinances, are applicable to the same facility. [See Table 2-1 for applicable National Pollutant Discharge Elimination System (NPDES) statutes and regulations.]

Permits and Permit Applications. Permits provide information on the limitations, requirements, and restrictions applicable to discharges; compliance schedules; and monitoring, analytical, and reporting requirements. Applications provide technical information on facility size, layout, and location of pollutant sources; treatment and control practices; contingency plans and emergency procedures; and pollutant characterization--types, amounts, and points/locations of discharge. Applications for air, solid, and hazardous waste treatment and disposal permits may provide additional information to the inspector that is not available elsewhere.

Regional and State Files and Contacts. Files or contacts often can provide correspondence; facility self-monitoring data; inspection, Quarterly Noncompliance Report (QNCR), and DMR QA reports; and permits and permit applications applicable to individual facilities. They can provide compliance, enforcement, and litigation history; special exemptions and waivers applied for and granted or denied; citizen complaints and action taken; process operational problems/solutions; pollution problems/solutions; laboratory capabilities or inabilities; and other proposed or historical remedial actions. This information can provide design and operation data, recommendations for process controls, identification of pollutant sources, treatment/control systems improvement, and remedial measures.

Technical Reports, Documents, and References. These information sources provide generic information on waste loads and characterization, industrial process operations, and pertinent specific data on available treatment/control

techniques, such as their advantages or disadvantages and limits of application and pollutant removal efficiencies. Such sources include Development Documents for Effluent Standards and Guidelines.

Other Statutory Requirements. Facility files maintained pursuant to other statutes [e.g., Toxic Substances Control Act (TSCA); Resource Conservation and Recovery Act (RCRA); Comprehensive Environmental Response, Compensation and Liability Act (CERCLA); Federal Insecticide, Fungicide and Rodenticide Act (FIFRA); Clean Air Act (CAA), etc.] also contain information useful to the NPDES inspection.

Development of an Inspection Plan

Plans are helpful tools in organizing and conducting compliance inspections. A plan is, therefore, recommended to effectively conduct a compliance inspection. After reviewing the available background information, a comprehensive plan is prepared to define inspection objectives; tasks and procedures; resources required to fulfill the objectives; the inspection schedule; and when findings and conclusions on the work will be reported. At least the following items need to be considered:

- Objectives

  - What is the purpose of the inspection?
  - What is to be accomplished?

- Tasks

  - What tasks are to be conducted?
  - What information must be collected?

- Procedures

  - What procedures are to be used?
  - Will the inspection require special procedures?

- Resources

  - What personnel will be required?
  - What equipment will be required?
  - What records will be reviewed?

- Schedule

  - What will be the time requirements and order of inspection activities?
  - What will be the milestones?

- Coordination

  - What coordination with laboratories or other regulatory agencies is required?

An outline of inspection objectives, meetings to be held, and records that will be reviewed can be prepared and presented to the facility officials during the opening conference.

Notification of the Facility

With regard to the EPA administered NPDES program, the permittee sometimes is notified by a "308 Letter" that the facility is scheduled for an inspection. (Figure 2-1, presented at the end of this section, is an example of a typical 308 Letter.) The signature authority for a 308 Letter may be delegated to a section chief. The 308 Letter advises the permittee that an inspection is imminent and usually requests information regarding on-site safety regulations to avoid problems concerning safety equipment at the time of inspection. The inspector may wish to facilitate the inspection process by suggesting that the permittee send general information to the inspector before the site visit. This information may include such items as names, addresses, and updated process information. The 308 Letter may specify the exact date of inspection, if coordination with the permittee is required. The 308 Letter also is used to inform the permittee of the right to assert a claim of confidentiality. Depending on the type of inspection, the permittee may be notified by telephone that an inspection is imminent. However, inspections are usually done without any pre-notification of the exact date.

Notification is not recommended when illegal discharges or emissions or improper records are suspected. The concern that physical conditions may be altered before the inspection or that records will be destroyed justifies an unannounced inspection. A written notification including information on the right to assert a claim of confidentiality can be presented at the time of the unannounced inspection.

State Notification of Federal Inspection

The inspector must be certain that the appropriate State regulatory agency is notified in a timely manner of inspections to be conducted in its jurisdiction. The State should be notified of all Federal inspections unless disclosing inspection information would jeopardize an unannounced inspection.

Equipment Preparation

Part of the pre-inspection process involves obtaining and preparing inspection equipment. The type of equipment may vary according to the facility inspected and the type of inspection. All equipment must be checked, calibrated, and tested before use. The inspector also must ensure

that all materials necessary to complete an inspection are taken to the inspection site. The inspector is responsible for maintaining the equipment properly in accordance with operating instructions.

Safety equipment and procedures required for a facility will be based on the response to the notification or 308 Letter and standard safety procedures. Safety requirements must be met, not only for safety reasons, but to ensure that the inspector is not denied entry to the facility or parts of it.

Photocopies of appropriate checklists to be used during the inspection should be obtained during the pre-inspection preparation.

Table 2-1

NPDES-Related Statutes and Regulations

Topic	Reference	
	CWA[1]	40 CFR[2]
Inspection Authority	§308	122.41(i),[a] 123.26[a]
Self-Monitoring and Recordkeeping Authority	§308	122.41(h), (j), and (l),[a] 122.48[a]
Confidential Information	§308(b)	2.201, 2.215, 2.302, 122.7[b]
Emergency Authority	§504	123.27[a]
Employee Protection	§507	----
Permits	§402	122,[b] 123.25[a]
EPA Permitting Procedures	§402	124
Technical Requirements	§§301,304,307	129,[a] 133,[a] 136[a]
Best Management Practices (BMP)	§304(e)	125
Spill Prevention Control and Countermeasure Plan (SPCC)	§311	112
Waivers	§301	125, 230
Effluent Guidelines	§304	400-460[a]
Pretreatment Standards	§§307, 402	125, 403, and 400-460[a]

[1] Clean Water Act
[2] Code of Federal Regulations, Revised as of July 1, 1986

[a] Applies to State programs
[b] Partially applies to State programs

Certified Mail - Return Receipt Requested

Date

Dear Sir:

Pursuant to the authority contained in Section 308 of the Clean Water Act (33 U.S.C. 1251 et seq.), representatives of the U.S. Environmental Protection Agency (EPA), or a contractor retained by EPA, shall conduct, within the next year, a compliance monitoring inspection of your operations, including associated waste treatment and/or discharge facilities located at (site of inspection). This inspection will ascertain the degree of compliance with the requirements of the National Pollutant Discharge Elimination System (NPDES) permit issued to your organization.

Our representatives may observe your process operations, inspect your monitoring and laboratory equipment and methods, collect samples, examine appropriate records, and will be concerned with related matters.

In order to facilitate easy access to the plant site, please provide the name of the responsible facility official who can be contacted upon arrival at the plant. Additionally, we would appreciate receiving a list of the safety equipment you would recommend that our representatives have in their possession in order to enter and conduct the inspection safely. Please provide the information requested within 14 days of receipt of this letter.

If you have any questions concerning this inspection, please call (appropriate designated official).

Sincerely,

Director
Water Management Division

Figure 2-1

Sample 308 Letter

B ENTRY

Entry Procedures

Authority

The basic authority for entry into a wastewater facility is §308(a)(4)(B) of the CWA which states:

> the Administrator or his authorized representative, upon presentation of his credentials shall have a right of entry to, upon, or through any premises in which an effluent source is located or in which any records are required to be maintained . . . and may at reasonable times have access to and copy any records, inspect any monitoring equipment or method . . . and sample any effluents which the owner or operator of such source is required to sample.

Arrival

Arrival at the facility should occur during normal working hours. The facility owner or agent in charge should be located as soon as the inspector arrives on the premises.

Credentials

When the proper facility officials have been located, the inspector must introduce himself or herself as an EPA/State inspector and present the proper EPA credentials. These credentials indicate that the holder is a lawful representative of the regulatory agency and is authorized to perform NPDES inspections. The credentials must be presented whether or not identification is requested.

After facility officials have reviewed the credentials, they may telephone the appropriate State or EPA Regional Office for verification of the inspector's identification. Credentials should never leave the sight of the inspector.

Consent

Consent to inspect the premises must be given by the owner or operator at the time of the inspection. As long as the inspector is allowed to enter, entry is considered voluntary and consentual, unless the inspector is expressly told to leave the premises. Expressed consent is not necessary; absence of an expressed denial constitutes consent.

Reluctance to Give Consent. The receptiveness of facility officials toward inspectors is likely to vary among facilities. Most inspections will proceed without difficulty. If consent to enter is flatly denied, the inspector should follow denial of entry procedures. In other cases, officials may be reluctant to give entry consent because of misunderstood responsibilities, inconvenience to a firm's schedule, or other reasons that may be overcome by diplomacy and discussion.

Whenever there is a difficulty in gaining consent to enter, inspectors should tactfully probe the reasons and work with officials to overcome the problems. Care should be taken, however, to avoid threats of any kind, inflammatory discussions, or deepening of misunderstandings. If the situation is beyond the authority or ability of the inspector to manage, the regulatory office should be contacted for guidance.

Uncredentialed Persons Accompanying an Inspector. The consent of the owner or agent in charge must be obtained for persons accompanying an inspector to enter a site if they do not have specific authorization. If consent is not given, these persons may not enter the premises. If consent is given, they may not view confidential business information unless officially authorized for access.

Waivers, Releases, and Sign-In Logs

When the facility provides a blank sign-in sheet, log, or visitor register, it is acceptable for inspectors to sign it. However, EPA employees must not sign any type of "waiver" or "visitor release" that would relieve the facility of responsibility for injury or that would limit the rights of EPA to use data obtained from the facility. The inspector must not agree to any such unwarranted, restrictive conditions.

If such a waiver or release is presented, the inspectors should politely explain that they cannot sign and request a blank sign-in sheet. If the inspectors are refused entry because they do not sign the release, they should leave and immediately report all pertinent facts to the appropriate supervisory and/or legal staff. All events surrounding the refused entry should be fully documented. Problems should be discussed cordially and professionally. Facility officials must not be subjected to intimidation by the Federal/State inspectors.

Problems With Entry or Consent

Because inspections may be considered adversarial proceedings, the legal authority, techniques, and competency of inspectors may be challenged. Facility officials also may display antagonism toward EPA personnel. In all cases, inspectors must cordially explain the authorities and reasons for the protocols followed. If explanations are not satisfactory or disagreements are irresolvable, the inspectors should leave and obtain further direction from the appropriate EPA supervisory or legal staff. Professionalism and politeness must prevail at all times.

Denial of Entry

If an inspector is refused entry into a facility for the purpose of an inspection under the CWA, certain procedural steps must be followed. The procedures have been developed in accordance with the 1978 U.S. Supreme Court decision in Marshal v. Barlow's, Inc.

- Ensure that all credentials and notices are presented properly to the facility owner or agent in charge.

- If entry is not granted, ask why. Tactfully probe the reason for the denial to see if obstacles (such as misunderstandings) can be cleared. If resolution is beyond the authority of the inspector, he or she may suggest that the officials seek advice from their attorneys to clarify EPA's inspection authority under Section 308 of the CWA.

- If entry is still denied, the inspector should withdraw from the premises and contact his or her supervisor. The supervisor will confer with attorneys to discuss the desirability of obtaining an administrative warrant.

- All observations pertaining to the denial are to be carefully noted in the field notebook. Include such information as the facility name and exact address, name and title of person(s) approached, authority of person(s) who refused entry, date and time of denial, detailed reasons for denial, facility appearance, and any reasonable suspicions that refusal was based on a desire to cover up regulatory violations. All such information will be important should a warrant be sought.

Important Considerations

- Under no circumstances should the inspector discuss potential penalties or do anything that may be construed as coercive or threatening.

- Inspectors should use discretion and avoid potentially threatening or inflammatory situations. If a threatening confrontation occurs, the inspector should document it and then report it immediately to the staff attorney. If feasible, statements from witnesses should be obtained and included in the documentation.

Withdrawal of Consent During Inspection

If the facility agent in charge asks the inspector to leave the premises after the inspection has begun, the inspector should leave as quickly as possible following the procedures above for denial of entry. All activities and evidence obtained before the withdrawal of consent are valid. The inspector should ensure that all personal and government equipment is removed from the facility.

Denial of Access to Some Areas of the Facility

If, during the course of inspection, access to some parts of the facility is denied, the inspector should make a notation of the circumstances surrounding the denial of access and of the portion of the inspection that could not be completed. He or she then should proceed with the rest of the inspection. After leaving the facility, the inspector should contact his or her supervisor and staff attorney at the Regional Office to determine whether a warrant should be obtained to complete the inspection.

Warrants

The inspector may be instructed by EPA attorneys, under certain circumstances, to conduct an inspection under search warrant. A warrant is a judicial authorization for appropriate persons to enter specifically described locations to inspect specific functions. A pre-inspection warrant possibly could be obtained where there is reason to believe that entry will be denied when the inspector arrives at the facility or when the inspector anticipates violations that could be hidden during the time required to obtain a search warrant.

C OPENING CONFERENCE

Once credentials have been presented and legal entry has been established, the inspector can proceed to outline inspection plans with facility officials. At the opening conference, the inspector provides names of the inspectors, the purpose of the inspection, authorities under which the inspection is being conducted, and procedures to be followed. The Agency encourages cooperation between the inspectors and the facility officials in order to facilitate assignments and ensure the success of the inspection.

Considerations

Inspection Objectives

An outline of inspection objectives will inform facility officials of the purpose and scope of the inspection and may help avoid misunderstandings.

Order of Inspection

A discussion of the order in which the inspection will be conducted will help eliminate wasted time by allowing officials time to make records available and start up intermittent operations.

Meeting Schedules

A schedule of meetings with key personnel will allow facility officials adequate time to spend with the inspector.

List of Records

A list of facility records that will need to be reviewed as part of the inspection should be provided to facility officials. This will allow the officials adequate time to gather the records and make them available for the inspector.

Accompaniment

It is important that a facility official accompany the inspector during the inspection not only to answer questions and describe the plant and its principal operating characteristics, but also for safety and liability considerations. Discussion of such needs with facility officials will provide them the opportunity to allocate personnel for this purpose.

Permit Verification

The inspector should verify pertinent information included in the permit, such as name and address, receiving waters and discharge points.

Safety Requirements

The inspector should reaffirm which Occupational Safety and Health Administration (OSHA) and facility safety regulations will be involved in the inspection, and should determine if preparations were adequate.

Closing Conference

A post-inspection meeting should be scheduled with appropriate officials to provide a final opportunity to gather information, answer questions, present findings and deficiencies, and complete administrative duties.

New Requirements

The inspector should discuss and answer questions pertaining to any new rules and regulations that might affect the facility. If the inspector is aware of proposed rules that might affect the facility, he or she may wish to encourage facility officials to obtain a copy.

Split Samples

Facility officials should be informed during the opening conference of their right to receive a split of any physical sample collected for laboratory analysis. Officials should indicate at this point their desire to receive split samples so that arrangements can be made to secure the samples during inspection.

Photographs

Photographs can be used to prepare a more thorough and accurate inspection report, as evidence in enforcement proceedings, and to explain better conditions found at the plant. The facility officials, however, may object to the use of cameras on their property. If a mutually acceptable solution cannot be reached and photographs are considered essential to the inspection, EPA supervisory and legal staff should be contacted for advice.

Facility personnel also may request that any photographs taken during the visit be considered confidential. EPA is obliged to comply with this request pending further legal determination. Facility officials may refuse permission to take photographs unless they can see the finished print. Self-developing film, although of lower quality, is useful in certain situations. Duplicate photographs (one for the inspector and the other for the company) should also satisfy this need.

D DOCUMENTATION

Providing strong documentary support of discrepancies uncovered in an inspection is an inspector's basic responsibility. Documentation serves to "freeze" the actual conditions existing at the time of inspection so that evidence may be examined objectively by compliance personnel.

Documentation is a general term referring to all print and mechanical media produced, copied, or taken by an inspector to provide evidence of suspected violations. Some types are the field notebook, statements, photographs, drawings, maps, printed matter, mechanical recordings, and copies of records.

Inspector's Field Notebook

The core of all documentation relating to an inspection is the field notebook, which provides accurate and inclusive documentation of all inspection activities. A bound notebook should be used and entries should be made in permanent ink. The notebook will form the basis for written reports and should contain only facts and pertinent observations.

Language should be objective, factual, and free of personal feelings or terminology that might prove inappropriate. Notebooks become an important part of the evidence package and can be entered in court. The field notebook is a part of EPA's files and is not to be considered the inspector's personal record. Notebooks are held indefinitely pending disposition instructions.

Inspection Notes

Since an inspector may be called to testify in an enforcement proceeding, it is imperative that each inspector keep detailed records of inspections, investigations, samples collected, and related inspection functions. Notes taken by the inspector(s) and completed checklists can be stapled in the field notebook. Types of information that should be entered into the field notebook include:

Observations. All conditions, practices, and other observations that will be useful in preparing the inspection report or that will validate evidence should be recorded.

Documents and Photographs. All documents taken or prepared by the inspector such as the completed checklists for the inspection report should be noted and related to specific inspection activities. (Photographs taken at a sampling site should be listed and described.)

Unusual Conditions and Problems. Unusual conditions and problems should be noted and described in detail.

General Information. Names and titles of facility personnel and the activities they perform should be listed along with statements they have made and other general information. Weather condition should be recorded. Information about a facility's recordkeeping procedures may be useful in later inspections.

Samples

Samples are the evidence most frequently gathered by inspectors. For the analysis of a sample to be admissible as evidence, a logical and documented connection must be shown between samples taken and analytical results reported. This connection is shown by using a chain-of-custody system that identifies and accompanies a sample between the time it is collected and the time it is analyzed. Sampling techniques and procedures are discussed in detail in Chapter Five, "Sampling."

Statements

Inspectors can obtain a formal statement from a person who has personal, firsthand knowledge of facts pertinent to a potential violation. This statement of facts is signed and dated by the person who can testify to the facts in court and it may be admissible as evidence.

The principal objective of obtaining a statement is to record in writing, clearly and concisely, relevant factual information so that it can be used to document an alleged violation.

Procedures and Considerations

- Determine the need for a statement. Will it provide useful information? Is the person making the statement qualified to do so by personal knowledge?

- Ascertain all the facts. Make sure all information is factual and firsthand. Record those that are relevant and that the person can verify in court. Avoid taking statements that cannot be personally verified.

- In preparing a statement, use simple narrative style; avoid stilted language.

  - Narrate the facts in the words of the person making the statement.
  - Use the first-person singular ("I am manager of . . .").
  - Present the facts in chronological order (unless the situation calls for another arrangement).

- Positively identify the person (name, address, position).

- Show why the person is qualified to make the statement.

- Present the pertinent facts.

- Have the person read the statement and make any necessary corrections before signing. If necessary, read the statement to the person in the presence of a witness.

  - All mistakes that are corrected must be initialed by the person making the statement.

- Ask the person making the statement to write a brief concluding paragraph indicating that he or she read and understood the statement. This safeguard will counter a later claim that the person did not know what he or she was signing.

- Have the person making the statement sign it.

- If he or she refuses to sign the statement, elicit an acknowledgment that it is true and correct. Ask for a statement in his or her own hand ("I have read this statement and it is true, but I am not signing it because . . ."). Failing that, declare at the bottom of the statement that the facts were recorded as revealed and that the person read the statement and avowed it to be true. Attempt to have any witness to the statement sign the statement including witness' name and address.

- Provide a copy of the statement to the signer if requested.

Photographs

The documentary value of photographs ranks high as admissible evidence. Clear photographs of relevant subjects provide an objective record of conditions at the time of inspection. If possible, keep "sensitive" buildings or operations out of the photographed background.

When a situation dictates the use of photographs, the inspector should obtain the permittee's approval before taking them. The inspector should be tactful in handling any concerns or objections a permittee may have about the use of a camera. In some cases, the inspector may explain to the permittee's representative that wastestreams, receiving waters, and wastewater treatment facilities are public information, not trade secrets. In the event the permittee's representative still refuses to allow photographs and the inspector believes the photographs will have a substantial impact on future enforcement proceedings, Regional enforcement attorneys should be consulted for further instructions. At all times, the inspector is to avoid confrontations that might jeopardize the completion of the inspection. [Photographs always may be taken from areas of public access (e.g., across a stream, from a parking lot, etc.).]

Equipment

A single-lens reflex camera should be used whenever one is available. This type of camera will take high-quality photographs, enable the inspector to use a variety of film speeds, and allow the use of appropriate lenses. Fully automatic 35-mm and pocket cameras can also be used for routine inspections to record the conditions of the facility during the inspection.

All photographs should be made with color print film because additional equipment, such as a projector and screen, is not needed to review them. Also, the negatives from color print film are easily duplicated and the prints can be enlarged and distributed as needed.

Scale, Location, and Direction

It is sometimes useful to photograph a subject from a point that will indicate the location and direction of the subject. The addition of an object of known size (e.g., a person or an auto) will help indicate the approximate size of the subject.

Safety

In areas where there is a danger of explosion, flash photographs should not be taken. If there is a danger of electrical shock, photographs should be taken from a distance known to be safe.

Documenting Photographs

Photographs taken during an inspection are used to supplement the testimony of the inspector as a witness during a court proceeding. The photographs are not intended to refute testimony but rather to aid the witness in recalling actual conditions on-site.

A photographic log should be maintained in the inspector's field notebook for all photographs taken during an inspection; the entries should be made at the time the photograph is taken. These entries are to be numerically identified so that, after the film is developed, the prints

can be serially numbered to correspond with the logbook descriptions and, if necessary, pertinent information can be easily transferred to the back of the photograph. The log entries should include:

- Name and signature of the photographer and witness
- Time of day, weather conditions
- Date
- Location
- Brief description of each subject being photographed.

Some Regions use special stick-on labels to document photographs. These are useful only if they are prepared objectively and are completely filled in.

Video Tapes

Video tapes can provide an objective means of documenting subjects of interest in an inspection. As with any photographed site or equipment, permission from the permittee to produce a video tape should be obtained, and the same precautions as those for photographs (previous section) should be taken for sensitive material. Additionally, sound videos may be produced whereby a narrative to the tape can quickly record much of the information needed to complete an inspection report. Written notes should be prepared during the site visit as a backup to the video tape in case mechanical problems occur with the recording. If necessary, color photographs can be made later by stopping the televised video at frames of interest and photographing the picture.

Drawings and Maps

Schematic drawings, maps, charts, and other graphic records can be useful in supporting violation documentation. They can provide graphic clarification of site location relative to the overall facility, relative height and size of objects, and other information which, in combination with samples, photographs, and other documentation, can produce an accurate, complete evidence package.

Drawings and maps should be simple and free of extraneous details. Basic measurements and compass points should be included to provide a scale for interpretation. Drawings and maps should be identified by source and be dated.

Printed Matter

Brochures, literature, labels, and other printed matter may provide important information regarding a facility's conditions and operations.

This materials may be collected as documentation if, in the inspector's judgment, they are relevant. All printed matter should be identified with date, inspector's initials, and origin.

Mechanical Recordings

Records produced electronically or by mechanical apparatus can be entered as evidence. Charts, graphs, and other "hard copy" documents should be treated as documentation and handled accordingly.

Copies of Records

Records and files may be stored in a variety of information retrieval systems, including written or printed materials, computer or electronic systems, or visual systems such as microfilm and microfiche.

Obtaining Copies of Necessary Records

When copies of records are necessary for an inspection report, storage and retrieval methods must be considered.

- Written or printed records generally can be photocopied on-site. Portable photocopy machines may be available to inspectors through the Regional Office. When necessary, however, inspectors are authorized to pay a facility a "reasonable" price for the use of facility copying equipment.

  - At a minimum, all copies made for or by the inspector should be initialed and dated for identification purposes. (See identification details below.)
  - When photocopying is impossible or impractical, closeup photographs may be taken to provide suitable copies.

- Computer or electronic records may require the generation of "hard" copies for inspection purposes. Arrangements should be made during the opening conference, if possible, for these copies.

  - Photographs of computer screens possibly may provide adequate copies of records if other means are impossible.

- Visual systems (microfilm, microfiche) may have photocopying capacity built into the viewing machine, which can be used to generate copies. Photographs of the viewing screen may provide adequate copies if hard copies cannot be generated.

Identification Procedures

Immediate and adequate identification of records reviewed is essential to ensure the identification of records throughout the EPA custody process and their admissibility in court. When inspectors are called to testify, they must be able to identify positively each particular document and state its source and the reason for its collection.

Initial, date, number, and enter in the facility's name on each record, and log these items in the field notebook.

Initialing/Dating. Each inspector should develop a unique system for initialing (or coding) and dating records and copies of records so that he or she can easily verify their validity. This can be done by initialing each document in a similar position, or by another method, at the time of collection. Both the original and copy should be initialed. All record identification notations should be made on the back of the document. The inspector must be able to identify positively that he or she so marked the document.

Numbering. Each document or set of documents substantiating a suspected violation(s) should be assigned an identifying number unique to that document. The number should be recorded on each document and in the field notebook.

Logging. Documents obtained during the inspection should be entered in the field notebook by a logging or coding system. The system should include the identifying number, date, and other relevant information:

- The reason for copying the material (i.e., the nature of the suspected violation or discrepancy)
- The source of the record (i.e., type of file, individual who supplied record)
- The manner of collection (i.e., photocopy, other arrangements).

General Considerations

- Originals must be returned to the proper person or to their correct location
- Related records should be grouped together
- Confidential business records should be handled according to the special confidential provisions discussed below.

Routine Records

The inspector may find it convenient to make copies of some records, such as laboratory analysis sheets and data summaries, to refresh his or her memory when preparing the inspection report. It is not always necessary to follow the formal identification and logging requirements when such records are obtained for general information purposes or to aid in the preparation of routine inspection reports.

Confidential Information

Disclosure of Official Information

Inspectors may give general information about EPA programs and activities and describe what they are doing, but they should be cautious about divulging specific information regarding an inspection. It is permissible to discuss with the permittee's representative deficiencies encountered during an evaluation of self-monitoring procedures and the action required to correct these deficiencies. However, it is not advisable to discuss information collected during the course of an inspection that may indicate the occurrence of a criminal or civil violation. Therefore, when an inspector has reason to believe that an enforcement action may be required, no information should be disclosed before consulting with the attorney in the Regional Office. Caution should be exercised in disclosing findings or speculating on the type of action EPA may choose to take.

Trade Secrets and Confidential Business Information

Trade secrets and confidential business information are protected from public disclosure by Section 308(b)(2) of the CWA. The type of information that may be considered confidential business information is defined in Title 40, Code of Federal Regulations, Part 2 (40 CFR Part 2).

Section 308(a)(4) of the CWA states that an inspector may sample an effluent, request information, have access to the location of the effluent, and inspect any monitoring equipment. The information that is collected is available to the public. If a permittee does not want inspection information to be available to the public, he or she must request the EPA Administrator to consider the information confidential. The permittee must show that the information, if made available, would divulge trade secrets. The information then may be classified confidential, but still may be disclosed to authorized representatives of EPA concerned with enforcing the Act.

Therefore, a business is entitled to a claim of confidentiality for <u>all</u> information that an inspector requests or has access to; however, a business may not refuse to release information requested by the inspector under the authority of Section 308 of the Act on the grounds that the information is considered confidential or a trade secret. The claim of confidentiality relates only to the public availability of such data and cannot be used to deny access to a facility to EPA inspectors performing duties under Section 308 of the Act.

Handling Confidential Business Information

Routine security measures will help ensure that reasonable precautions are taken to prevent unauthorized persons from viewing confidential information. When practical circumstances prohibit the inspector from following the procedures exactly, he or she should take steps to protect

the information. All confidential information received must be marked as such and placed in a locked filing cabinet or a safe immediately after the inspection is completed. A chain-of-custody record must be maintained for all confidential information.

While Traveling. The inspector may be on the road for several days while conducting inspections. The inspector is responsible for ensuring that the information collected is handled securely.

- Documents and field notes are considered secure if they are in the physical possession of the inspector and are not visible to others while in use.

- Inspection documents contain sensitive information and should be kept in a locked briefcase. If it is impractical to carry the briefcase, the briefcase may be stored in a locked area, such as a motel room or trunk of a motor vehicle.

- Physical samples should be placed in locked containers and stored in a locked portion of a motor vehicle. The chain-of-custody procedures provide further protection for ensuring the integrity of the sample.

In the Office. Only personnel authorized by the Regional Administrator, Division Director, or Branch Chief will be allowed access to the file. An access log should be maintained for all transactions. Copies should not be made of information marked "trade secret" and/or "confidential" unless written authorization has been obtained from the Regional Administrator, Division Director, or Branch Chief. Requests for access to confidential information by any member of the public, or by an employee of a Federal, State, or local agency, shall be handled according to the procedures contained in the Freedom of Information Act regulations (40 CFR Part 2). All such requests shall be referred to the responsible Regional organizational unit.

E CLOSING CONFERENCE

To achieve the most effective results from compliance inspections, the inspector must communicate results promptly to the facility management and/or operating personnel. However, the inspector's discussion should be limited to specific findings of the visit. If appropriate, findings should be compared with the permittee's NPDES permit requirements, consent decrees, administrative orders, and other enforcement actions.

Precautions and Guidelines

Although a discussion of the inspection results is important, certain precautions are essential:

- The inspector should not discuss compliance status or any legal effects or enforcement consequences with the permittee's representative or with facility operating personnel.
- The inspector should refrain from recommending a particular consultant or consulting firm, even if asked to do so. Inspectors should tell the permittee's representative to contact a professional society or approved listing for advice concerning this matter.

These guidelines are subject to rules promulgated by the Regional Administrator or State Director regarding permittee contacts in the Region/State.

Deficiency Notice

The inspector may issue a Deficiency Notice that specifies existing or potential problems in a permittee's self-monitoring program. Issuing a Deficiency Notice on-site or after the site visit provides a swift and simple method for improving the quality of data from NPDES self-monitoring

activities. An example Deficiency Notice is provided in Figure 2-2. Notices allow the inspector formally to assign responsibility to the permittee, and to track each stage of the compliance/enforcement process. The Deficiency Notice also helps the permittee comply with the self-monitoring requirements of the permit.

This tool should be used in conjunction with any type of NPDES compliance inspection during which the inspector identifies problems with the permittee's self-monitoring activities. It is to be used by the inspector only to alert permittees to deficiencies in their self-monitoring activities. The enforcement office of the regulatory authority, not the inspector, handles effluent violations.

Inspectors can issue the Deficiency Notice to a permittee immediately following a compliance inspection, or after the site visit is completed, if they discover any permit deficiencies in the following seven categories that the Notice addresses:

- Monitoring location
- Flow measurement
- Sample collection/holding time
- Sample preservation
- Test procedures, Section 304(h), 40 CFR Part 136
- Recordkeeping
- Other self-monitoring deficiencies.

DEFICIENCY NOTICE

NATIONAL POLLUTANT DISCHARGE ELIMINATION SYSTEM *(NPDES)*

(Read instructions on back of last part before completing)

PERMITTEE *(Facility)* NAME AND ADDRESS

PERMITTEE REPRESENTATIVE *(Receiving this Notice)*/ TITLE

NPDES PERMIT NO.

During the compliance inspection carried out on *(date)* _____ the deficiencies noted below were found. Additional areas of deficiency may be brought to your attention following a complete review of the Inspection Report and other information on file with the REGULATORY AUTHORITY administering your NPDES PERMIT.

D E F I C I E N C I E S

MONITORING LOCATION *(Describe)*

FLOW MEASUREMENT *(Describe)*

SAMPLE COLLECTION/HOLDING TIME *(Describe)*

SAMPLE PRESERVATION *(Describe)*

TEST PROCEDURES, SECTION 304(h), 40 CFR 136 *(Describe)*

RECORD KEEPING *(Describe)*

OTHER SELF-MONITORING DEFICIENCIES *(Describe)*

ADDITIONAL COMMENTS

REQUESTED ACTION—Your attention to the correction of the deficiencies noted above is requested. Receipt of a description of the corrective actions taken will be considered in the determination of the need for further Administrative or Legal Action. Your response is to be **(Inspector line out inappropriate response method)**: *(1) included with your next NPDES Discharge Monitoring Report (DMR) or (2) submitted as directed by the inspector.* Questions regarding possible follow-up action can be answered by the REGULATORY AUTHORITY to which your DMRs are submitted and which administers your NPDES Permit.

INSPECTOR'S SIGNATURE	INSPECTOR'S ADDRESS/PHONE NO.	REGULATORY AUTHORITY/ADDRESS	DATE
INSPECTOR'S PRINTED NAME			

EPA Form 3560-4 (2-80)

Figure 2-2

EPA Deficiency Notice Form

F INSPECTION REPORT

The adequacy of compliance follow-up to correct problems or deficiencies noted during inspection greatly depends on the report prepared by the inspector. The sections of this chapter detail procedures for collecting and substantiating the information used to prepare this report. Once collected, however, the material must be organized and arranged so that compliance personnel can make maximum use of it. The information presented in this section provides general guidelines for organizing evidence and preparing an inspection report.

Objective of the NPDES Inspection Report

The objective of a NPDES inspection report is to organize and coordinate all inspection information and evidence into a comprehensive, usable document. To meet this objective, information in an inspection report must be presented in a clear, well-organized manner. The information should be objective and factual; the report should not speculate on the ultimate result of the inspection findings. Of particular importance are the following:

- Accurate information must be included in the report. It should be factual and based on sound inspection practices. Observations should be the verifiable result of firsthand knowledge. Compliance personnel must be able to depend on the accuracy of all information.

- Information in an inspection report should be relevant to the subject of the report. Irrelevant facts and data will clutter a report and may reduce its clarity and usefulness. Personal comments and opinions should be avoided.

- Suspected violation(s) should be substantiated by as much factual, relevant information as is feasible to gather. All information pertinent to the subject should be organized into a complete package. Documentary support (e.g., photographs, statements, sample documentation, etc.) accompanying the report should be referenced clearly so that anyone reading the report will get a complete, clear overview of the situation. The more comprehensive the evidence is, the better and easier the prosecution's task will be.

Elements of a Report

Although specific information requirements for an inspection report will vary, most reports will contain the same basic elements:

- NPDES Compliance Inspection Report Form
- Supplementary narrative information
- Copies of completed checklists
- Documentary support.

NPDES Compliance Inspection Report Form

The inspector is responsible for reporting all compliance inspection activities by completing the current Compliance Inspection Report Form as soon as possible after the inspection. A copy of the form is included as Figure 2-3. The Federal or State compliance office should forward the inspection report form to the regulatory authority no later than 30 days after completion of the inspection. Copies should be sent to the permittee in a timely manner except when formal enforcement procedures are under way. In this instance, the case attorney will direct any disclosure of data.

Supplementary Narrative Information

Supplementary narrative information could be a memorandum in the case of routine inspections or a narrative report when major violations are detected. When a narrative report is necessary to describe fully a compliance inspection, the contents of the report should focus on supporting or explaining the information provided in the Compliance Inspection Report Form.

The narrative report should be a concise, factual summary of observations and activities, organized logically and legibly, and supported by specific references to accompanying documentary support.

A work plan will simplify preparation and will help ensure that information is organized in a usable form. Basic steps in writing the narrative report include:

Reviewing the Information. The first step in preparing the narrative is to collect all information gathered during the inspection. The inspector's field notebook should be reviewed in detail. All evidence should be reviewed for relevance and completeness. A telephone call or, in unusual circumstances, a follow-up visit may be needed to obtain additional or supplementary information.

Organizing the Material. The information may be organized according to need, but it should be presented logically and comprehensively. The narrative should be organized so that it is understood easily.

Referencing Accompanying Material. All documentary support accompanying a narrative report should be referenced clearly so that the reader will be able to locate the items easily. The "Documentation" section in this chapter provides details on document identification. All documentary support should be checked for clarity before writing the report.

Writing the Narrative Report. Once the material collected by the inspector has been reviewed, organized, and referenced, the narrative can be written. The purpose of the narrative is to record factually the procedures used in, and findings resulting from, the evidence-gathering process. The inspector should refer to routine procedures and practices used during the inspection, but should detail facts relating to potential violations and discrepancies. The field notebook is a guide for preparing the narrative report.

If the inspector has followed the steps presented in this manual, the report will develop logically from the organizational framework of the inspection. In preparing the narrative, simplicity should be paramount.

- Write simply; avoid stilted language
- Use the active, not passive, approach: (e.g., "He said that . . ." rather than "It was said that . . .")
- Keep paragraphs brief and to the point
- Avoid repetition
- Proofread the narrative carefully.

Copies of Completed Checklists

Comprehensive checklists are included in the technical chapters of this manual. When appropriate, these checklists may be used by the inspector to collect information during the inspection or they may be modified by the Region or State to address additional specific concerns. Copies of all completed checklists should be included in the inspection report.

Documentary Support

All documentation produced or collected by the inspector to provide evidence of suspected violations should be included in the inspection report. The "Documentation" section in this chapter provides details on obtaining and organizing this material.

The Permit Compliance System (PCS)

The inspection office should ensure that all data listed in Section A of the NPDES Compliance Inspection Report are entered into the PCS, which is used for National tracking of NPDES permit information. An inspection is not credited to the inspection program office until coded into the PCS. Therefore, timely completion of reports is essential to follow-up effectively a compliance inspection. Every effort should be made to ensure that data are entered no later than 30 days after the inspection is completed.

EPA

United States Environmental Protection Agency
Washington, D. C. 20460

NPDES Compliance Inspection Report

Form Approved
OMB No. 2040-0003
Approval Expires 7-31-85

Section A: National Data System Coding

Transaction Code 1 [ ] 2 [5] 3 [ ] NPDES 11 12 [ ] yr/mo/day 17 18 [ ] Inspection Type 19 [ ] Inspector 20 [ ] Fac Type

Remarks 21 [ ] 66

67 [ ] Reserved 69 70 [ ] Facility Evaluation Rating 71 [ ] BI 72 [ ] QA 73 [ ] 74 75 [ ] Reserved 80

Section B: Facility Data

Name and Location of Facility Inspected	Entry Time ☐ AM ☐ PM	Permit Effective Date
	Exit Time/Date	Permit Expiration Date

Name(s) of On-Site Representative(s)	Title(s)	Phone No(s)

Name, Address of Responsible Official	Title	
	Phone No.	Contacted ☐ Yes ☐ No

Section C: Areas Evaluated During Inspection

(S = Satisfactory, M = Marginal, U = Unsatisfactory, N = Not Evaluated)

	Permit		Flow Measurement		Pretreatment		Operations & Maintenance
	Records/Reports		Laboratory		Compliance Schedules		Sludge Disposal
	Facility Site Review		Effluent/Receiving Waters		Self-Monitoring Program		Other:

Section D: Summary of Findings/Comments *(Attach additional sheets if necessary)*

Name(s) and Signature(s) of Inspector(s)	Agency/Office/Telephone	Date
Signature of Reviewer	Agency/Office	Date

Regulatory Office Use Only

Action Taken	Date	Compliance Status ☐ Noncompliance ☐ Compliance

Figure 2-3

NPDES Compliance Inspection Report Form

INSTRUCTIONS

Section A: National Data System Coding *(i.e., PCS)*

Column 1: Transaction Code: Use N, C, or D for New, Change, or Delete. All inspections will be *new* unless there is an error in the data entered.

Columns 3-11: NPDES Permit No. Enter the facility's NPDES permit number. *(Use the Remarks columns to record the State permit number, if necessary.)*

Columns 12-17: Inspection Date. Insert the date entry was made into the facility. Use the year/month/day format (e.g., 82/06/30 = June 30, 1982).

Column 18: Inspection Type. Use one of the codes listed below to describe the type of inspection:

A — Performance Audit
B — Biomonitoring
C — Compliance Evaluation
D — Diagnostic
E — Corps of Engrs Inspection
L — Enforcement Case Support
P — Pretreatment
R — Reconnaissance Inspection
S — Compliance Sampling
X — Toxic Sampling

Column 19: Inspector Code. Use one of the codes listed below to describe the *lead agency* in the inspection.

C — Contractor or Other Inspectors *(Specify in Remarks columns)*
E — Corps of Engineers
J — Joint EPA/State Inspectors—EPA lead
N — NEIC Inspectors
R — EPA Regional Inspector
S — State Inspector
T — Joint State/EPA Inspectors—State lead

Column 20: Facility Type. Use one of the codes below to describe the facility.

1 — Municipal. Publicly Owned Treatment Works (POTWs) with 1972 Standard Industrial Code (SIC) 4952.
2 — Industrial. Other than municipal, agricultural, and Federal facilities.
3 — Agricultural. Facilities classified with 1972 SIC 0111 to 0971.
4 — Federal. Facilities identified as Federal by the EPA Regional Office.

Columns 21-66: Remarks. These columns are reserved for remarks at the discretion of the Region.

Column 70: Facility Evaluation Rating. Use information gathered during the inspection (regardless of inspection type) to evaluate the quality of the facility self-monitoring program. Grade the program using a scale of 1 to 5 with a score of 5 being used for very reliable self-monitoring programs, 3 being satisfactory, and 1 being used for very unreliable programs.

Column 71: Biomonitoring Information. Enter D for static testing. Enter F for flow through testing. Enter N for no biomonitoring.

Column 72: Quality Assurance Data Inspection. Enter Q if the inspection was conducted as followup on quality assurance sample results. Enter N otherwise.

Columns 73-80: These columns are reserved for regionally defined information.

Section B: Facility Data

This section is self-explanatory.

Section C: Areas Evaluated During Inspection

Indicate findings (S, M, U, or N) in the appropriate box. Use Section D and additional sheets as necessary. Support the findings, as necessary, in a brief narrative report. Use the headings given on the report form (e.g., Permit, Records/Reports) when discussing the areas evaluated during the inspection. The heading marked "Other" may include activities such as SPCC, BMP's, and multimedia concerns.

Section D: Summary of Findings/Comments

Briefly summarize the inspection findings. This summary should abstract the pertinent inspection findings, not replace the narrative report. Reference a list of attachments, such as completed checklists taken from the NPDES Compliance Inspection Manuals and pretreatment guidance documents, including effluent data when sampling has been done. Use extra sheets as necessary.

Figure 2-3

NPDES Compliance Inspection Report Form (Continued)

Chapter Three

RECORDKEEPING AND REPORTING

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Chapter Three

A INSPECTION AUTHORITY AND OBJECTIVES

Authority and Objectives

Statutory Recordkeeping Authority:	Clean Water Act §308 and §402
Regulatory Requirements:	40 CFR Parts 122.41 and 122.48
Inspection Authority:	Clean Water Act §308

The National Pollutant Discharge Elimination System (NPDES) permit system requires permittees to maintain records and report periodically on the amount and nature of effluent waste components. The permit stipulates recordkeeping and reporting conditions. Evaluations are conducted at all permittee facilities to determine compliance with permit requirements. The procedures listed below should be used for these routine inspections. If suspected violations are disclosed during the routine evaluation, a more intensive investigation should be conducted.

A review of facility records should determine that recordkeeping requirements are being met. In particular:

- Is all required information available?
- Is the information current?
- Is the information being maintained for the required time period?
- Do the records reviewed indicate areas needing further investigations?
- Are the records organized?

B EVALUATION PROCEDURES

Verification, Recordkeeping, and Reporting Evaluation Procedures

During the facility site inspection, the inspector should verify the following requirements of the permit:

- That the number and location of discharges are as described in the permit
- That all discharges are in accordance with the general provisions of the permit, such as: no noxious odors, no discharge, no visible entrained solids in discharge, and no fish or vegetation kills near the outfalls.

The inspector should review the permit to determine recordkeeping and reporting requirements. Throughout the inspection, the facility's operations should be compared with the permit to verify that required permit activities are correct, current, and complete. Some of the information needed to verify the permit can be obtained during the opening conference and compared with the facility permit. This information includes:

- Correct name and address of facility
- Correct name and location of receiving waters
- Number and location of discharge points
- Principal products and production rates (where appropriate).

The inspector should check for records that will verify that notification has been made to EPA or to the State when: (1) discharges differ from those stated in the permit, (2) a permit violation has occurred, and (3) bypassing has occurred. The inspector should also check to ensure that the appropriate records are maintained for a minimum of 3 years. These records may include:

- Sampling and Analysis Data

  - Dates, times, and locations of sampling
  - Analytical methods and techniques
  - Results of analyses
  - Dates and times of analyses
  - Name(s) of analysis and sampling personnel.

- Monitoring Records

  - Discharge Monitoring Reports (DMRs) including information on flow, pH, Dissolved Oxygen (DO), etc., as required by permit
  - Original charts from continuous monitoring instrumentation.

- Laboratory Records

  - Calibration and maintenance of equipment
  - Calculations (i.e., on bench sheets or books)
  - Quality Assurance/Quality Control (QA/QC) analysis data.

- Facility Operating Records

  - Daily operating log
  - Summary of all laboratory tests run and other required measurements; should reference test method used (general reference to Standard Methods is not adequate)
  - Chemicals used (pounds of chlorine per day, etc.)
  - Weather conditions (temperature, precipitation, etc.)
  - Equipment maintenance completed and scheduled.

- Treatment Plant Records (required as part of the Federal Construction Grants program)

  - Plant Operations and Maintenance (O&M) Manual
  - Percent removal records
  - "As built" engineering drawings
  - Copy of construction specifications
  - Equipment supplier manual
  - Data cards on all equipment.

- Management Records

  - Average monthly operating records
  - Annual reports
  - Emergency conditions (power failures, bypass and chlorine failure reports, etc.).

- Pretreatment Records

  - Publicly Owned Treatment Works (POTW) and industrial monitoring and reporting requirements
  - Industrial user discharge data
  - Compliance status records
  - POTW enforcement initiatives.

- Spill Prevention Control and Countermeasure (SPCC) Plan

  When required, a properly completed SPCC Plan should be available. The inspector also may complete the SPCC inspection form and forward the completed form to the appropriate program office for follow-up action.

- Best Management Practices

  Two types of Best Management Practices (BMP) are included in NPDES permits:

  - BMP plans to minimize or prevent release of significant amounts of any toxic or hazardous pollutants to public waters. The plans may discuss general operations and maintenance of the plant, good housekeeping procedures on the facility grounds, and other plans and procedures specific to best management of the facility.

  - Site-specific BMP to address particular toxic or hazardous chemicals or other conditions particular to the facility. Site-specific BMP may include procedures, monitoring requirements, construction of barriers such as dikes and berms, or other appropriate measures for solving specific problems.

The inspector should document all inspection activities (see Chapter Two, Section D). Inadequacies, discrepancies, or other problems disclosed during this review may warrant more intensive investigation.

Compliance Schedule Status Review

If the permit contains a compliance schedule, a status review should be conducted to determine:

- Whether the permittee is conforming to the compliance schedule and, if not, whether final requirements will be achieved on time
- The accuracy of reports relating to compliance schedules
- The length of delay associated with a particular construction violation
- Whether any schedule violations are beyond the control of the discharger
- Whether requests for permit modifications are valid.

If the permit contains a compliance schedule for actions such as beginning new construction, contract and equipment orders, authorization and financing arrangements, and/or attainment of operational status; the schedule should be addressed in detail only if the need becomes apparent during records review and preparation of the inspection plan. The specific compliance schedule actions are described below.

Construction Progress

The inspector must know whether contracts for labor and material have been fulfilled and whether the permittee or the permittee's engineering consultant is monitoring progress. These aspects are extremely important, particularly in plants where numerous contracts are likely for labor and equipment.

If the permittee or the engineering consultant reports that construction or the acquisition of equipment is behind schedule, the inspector should:

- Ask to see the permittee's or the resident engineer's progress report and determine whether the report indicates that the final compliance schedule required by the permit can be met.

- If the report indicates that the final date will not be met, advise the permittee that the compliance schedule of the NPDES permit requires the permittee to notify the permit-issuing authority promptly of any possible delay in achieving compliance and of measures taken to minimize the delay.

- Inquire whether the facility superintendent or chief operator and operating personnel are receiving adequate training concerning the operational aspects of the new treatment unit while construction is under way. They must be prepared to perform the essential operating functions when the facility is placed in service.

Construction Contracts and Equipment Orders

The inspector should review the appropriate documents to determine whether the permittee has obtained the necessary approval to begin construction. The inspector should note the start and completion dates (or scheduled delivery dates in service or equipment contracts).

Authorization and Financing

If construction is incomplete, the inspector should determine whether the permittee has the authority and financial arrangements (mortgage commitments, corporate resolution, etc.) to complete the required structures.

Attainment of Operational Status

If construction has been completed but the facility is not yet operational, the inspector should determine whether appropriate procedures are being used to ensure attainment of working status at the earliest possible time.

The inspector should verify that:

- Adequate self-monitoring procedures have been initiated. It is especially important that the result of operational and effluent quality monitoring be reviewed to determine whether progress is being made toward optimum efficiency in each treatment unit and in the entire plant.

- Adequate recordkeeping procedures have been established or initiated.

- Adequate work schedules and assignments have been established. (For municipal facilities, the O&M Manual should provide essential guidance.)

POTW Pretreatment Requirements Review

The inspector must collect specific information to evaluate compliance with pretreatment requirements. The procedures developed to collect this information are summarized below and discussed in greater detail in Chapter Nine, "Pretreatment."

The inspector must determine the status of pretreatment program development and/or implementation by the POTW.

- When was the program approved by EPA/State or is the approval in progress?
- Is the frequency of monitoring significant industrial discharges the same as stated in the approved pretreatment program?
- Have permits been issued to significant industrial users?
- Have inspections of significant industrial users been initiated?

As part of the inspection, the inspector must collect information about the compliance status of contributing significant industrial facilities with categorical pretreatment standards or locally developed discharge limitations. The inspector should review POTW records to determine:

- Number of contributing industries
- Whether these industries have been properly classified for the applicable standards
- Whether industries have submitted required reports to the POTW, including baseline monitoring reports, 90-day compliance reports, POTW required industrial self-monitoring reports, etc.
- Number of contributing industries in compliance with applicable standards
- Whether all noncompliant industries have been put on an enforceable compliance schedule
- Whether contributing industries with compliance schedules are meeting applicable schedule deadlines.

The inspector should note in the inspection report if the locally developed discharge limits applied are more stringent than EPA categorical pretreatment standards. The POTW is required to determine if locally developed discharge limitations are required to protect the collection system, treatment plant, sludge, and/or receiving waters from interference or pass through of industrial pollutants.

Indepth Investigations

An indepth inspection of a permittee's records and reports will be conducted when necessary to substantiate a suspected violation, to verify self-monitoring data that may be used as corroborative evidence in an enforcement action, or to confirm apparent sampling, analysis, or reporting discrepancies discovered during the limited inspection. Discrepancies warrant an indepth review if, for example:

- The discharge does not meet required standards and no definite operational problems have been established
- Self-reported data are suspected to be grossly inaccurate and the problem appears to be with recordkeeping procedures and/or the filing of reports
- The cursory review indicates omissions or laxity in the preparation of records
- There is evidence of falsification of records.

If more guidance or assistance is needed in performing an indepth investigation, the inspector should confer with his or her supervisor.

Indepth Investigation Procedures

The following procedures should guide the inspector in conducting an indepth investigation:

- Determine Investigation Objective. What is the specific purpose of the investigation?

- Determine Information Needed. What specific data will substantiate a violation or respond to the investigation objective?

- Determine Data Source. What records will contain these required data?

- Review Inspection Authority. Authority to inspect under Section 308 is limited to those records required by the permit. Specific authority may be necessary to inspect other documents.

- Inspect Direct and Indirect Data Sources. Examine records likely to provide the required data directly. In the absence of direct data, indirect sources of information can be used to develop a network of information relevant to the data being sought.

- Take Statements from Qualified Facility Personnel. See Chapter Two, Section D, for procedures.

- Prepare Documentation. Copy and identify all records relevant to the information being sought; see Chapter Two, Section D, for specific procedures.

- Follow Confidentiality Procedures. Any record inspected may be claimed by the facility as confidential. Such records must be treated in accordance with EPA procedures; see Chapter Two, Section D, the discussion on Confidential Business Information.

VERIFICATION, RECORDKEEPING, AND REPORTING EVALUATION CHECKLIST

A. PERMIT VERIFICATION

Mailing Address:

_____

_____

_____

_____

Brief Facility Description:

_____

_____

_____

Yes No N/A	1. Inspection observations verify information contained in permit.
Yes No N/A	2. Current copy of permit on-site.
Yes No N/A	3. Correct name and mailing address of permittee.
Yes No N/A	4. Facility as described in permit.
Yes No N/A	5. Notification given to EPA/State of new, different, or increased discharges.
Yes No N/A	6. Accurate records of influent volume maintained, when appropriate.
Yes No N/A	7. Number and location of discharge points as described in permit.
Yes No N/A	8. Name and location of receiving waters correct.
Yes No N/A	9. All discharges permitted.
Yes No N/A	10. Federal Construction Grant funds used to build plant.

B. RECORDKEEPING AND REPORTING EVALUATION

Yes No N/A	1. Records and reports maintained as required by permit.
Yes No N/A	2. All required information available, complete, and current.
Yes No N/A	3. Information maintained for 3 years.
Yes No N/A	4. Analytical results consistent with data reported on DMRs.
	5. Sampling and analyses data adequate and include:
Yes No N/A	a. Dates, times, and location of sampling
Yes No N/A	b. Name of individual performing sampling
Yes No N/A	c. Analytical methods and techniques
Yes No N/A	d. Results of analyses and calibration
Yes No N/A	e. Dates of analyses
Yes No N/A	f. Name of person performing analyses
Yes No N/A	g. Instantaneous flow at grab sample stations.
	6. Monitoring records adequate and include:
Yes No N/A	a. Flow, pH, DO, etc., as required by permit
Yes No N/A	b. Monitoring charts kept for 3 years
Yes No N/A	c. Flowmeter calibration records kept.
Yes No N/A	7. Laboratory equipment calibration and maintenance records adequate.

VERIFICATION, RECORDKEEPING, AND REPORTING EVALUATION CHECKLIST
(Continued)

	8. Plant records* adequate and include:
Yes No N/A	a. O&M Manual
Yes No N/A	b. "As-built" engineering drawings
Yes No N/A	c. Schedules and dates of equipment maintenance repairs
Yes No N/A	d. Equipment supplies manual
Yes No N/A	e. Equipment data cards.
	* Required only for facilities built with Federal construction grant funds.
	9. Pretreatment records adequate and include inventory of industrial waste contributors, including:
Yes No N/A	a. Monitoring data
Yes No N/A	b. Inspection reports
Yes No N/A	c. Compliance status records
Yes No N/A	d. Enforcement actions.

C. COMPLIANCE SCHEDULE STATUS REVIEW

Yes No N/A	1. Permittee is meeting compliance schedule.
Yes No N/A	2. Permittee has obtained necessary approvals to begin construction.
Yes No N/A	3. Financing arrangements complete.
Yes No N/A	4. Contracts for engineering services executed.
Yes No N/A	5. Design plans and specifications completed.
Yes No N/A	6. Construction begun.
Yes No N/A	7. Construction on schedule.
Yes No N/A	8. Equipment acquisition on schedule.
Yes No N/A	9. Construction completed.
Yes No N/A	10. Startup begun.
Yes No N/A	11. Permittee requested an extension of time.
Yes No N/A	12. Permittee met compliance schedule.

D. POTW PRETREATMENT REQUIREMENTS REVIEW

Yes No N/A	THE FACILITY IS SUBJECT TO PRETREATMENT REQUIREMENTS
	1. Status of POTW pretreatment program
Yes No N/A	a. The POTW pretreatment program has been approved by EPA. (If not, is approval in progress? _____)
Yes No N/A	b. The POTW is in compliance with the pretreatment program compliance schedule. (If not, note why, what is due, and intent of the POTW to remedy)

VERIFICATION, RECORDKEEPING, AND EVALUATION CHECKLIST
(Continued)

	2. Status of Compliance with Categorical Pretreatment Standards.
	a. How many industrial users of the POTW are subject to Federal or State pretreatment standards?_____
Yes No N/A	b. Are these industries aware of their responsibility to comply with applicable standards?
Yes No N/A	c. Have baseline monitoring reports (403.12) been submitted for these industries?
Yes No N/A	i. Have categorical industries in noncompliance (on BMR reports) submitted compliance schedules?
	ii. How many categorical industries on compliance schedules are meeting the schedule deadlines? _____
Yes No N/A	d. If the compliance deadline has passed, have all industries submitted 90-day compliance reports?
Yes No N/A	e. Are all categorical industries submitting the required semiannual report?
Yes No N/A	f. Are all new industrial discharges in compliance with new source pretreatment standards?
Yes No N/A	g. Has the POTW submitted an annual pretreatment report?
Yes No N/A	h. Has the POTW taken enforcement action against noncomplying industrial users?
Yes No N/A	i. Is the POTW conducting inspections of industrial contributors?
Yes No N/A	3. Are the industrial users subject to Prohibited Limits (403.5) and Local Limits more stringent than EPA in compliance? (If not, explain why, including need for revision of limits.)

Chapter Four

FACILITY SITE REVIEW

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Chapter Four

A OBJECTIVES

In performing a facility site review, an inspector examines treatment units, monitoring equipment, outfalls, and the receiving stream. In particular, the inspector focuses on areas of the permittee's premises where pollutants are pumped, conveyed, treated, stored, or disposed. The proper conduct of a facility site review requires that the inspector understand fully the wastewater treatment processes used at the facility and how each process fits into the overall treatment scheme.

The objectives of a facility site review are to:

- Assess the conditions of the facility's current treatment processes and operations
- Evaluate the permittee's operation and maintenance activities
- Check the completeness and accuracy of the permittee's performance/compliance records
- Determine if the treatment units are being operated as efficiently as possible.

During the overall review of the facility, the compliance inspector becomes more knowledgeable about the facility being inspected, reviews areas that may indicate problems with effluent limitations, and evaluates overall performance of the treatment facility. Because the information presented in this chapter is comprehensive, inspectors should use only the information applicable to a particular situation. A Facility Site Review Checklist for the inspectors' use is included at the end of this chapter.

B PHYSICAL INSPECTION OF THE FACILITY

During the physical "walk-through" of the facility, the inspector should consider the operational factors listed below. Since these factors may indicate problems, the physical inspection should be carefully documented. Areas that should be covered are:

- Influent characteristics, including:

  - Combined sewer loads
  - Infiltration/inflow
  - Industrial contributions
  - Diurnal/seasonal loading variations

- Process control
- Unit operations
- Equipment condition
- Safety controls and equipment
- Effluent characteristics, including:

  - Appearance of outfall
  - Receiving stream appearance
  - Evidence of toxicity of the discharge

- Other conditions particular to the plant.

EPA's Field Manual for Performance Evaluation and Trouble Shooting at Municipal Wastewater Facilities (USEPA 1978), published by the Municipal Operations Branch of EPA, is a good reference for operational characteristics of plants.

The physical inspection may lead the inspector to determine:

- Whether a major facility design problem requires an engineering solution
- If problem areas can be solved through proper operation and maintenance of the treatment facilities
- Whether periodic equipment malfunctions need to be addressed by complete overhaul or replacement of equipment.

If a facility design problem exists, one of the recommendations will be to develop engineering solutions. In this case, the inspector must evaluate the operation and maintenance procedures from the viewpoint of what can be done to simplify the solution. When the inspection findings indicate that specific practices of the facility contribute to or cause problems, the inspector should detail the problems and make recommendations. When possible the inspector should use the information to evaluate the operation and maintenance procedures.

When conducting the walk-through, the inspector should be aware of and look for physical conditions which indicate potential or existing problems. The presence of these conditions will give the inspector an idea of the types of problems present, the parts of the treatment process causing the problems, and the potential solution to existing problems. Conditions to look for in the plant generally and in specific processes are listed in the following sections.

General Conditions in Overall Plant

General Indicators

- Excessive scum buildup, grease, foam, or floating sludge in clarifiers
- Hydraulic overload caused by storms or discharges of cooling water
- Noxious odors in wet wells and grit chambers and around aerobic and anaerobic biological units, scum removal devices, and sludge handling facilities
- Evidence of severe corrosion at the treatment plant and in the collection system
- Discoloration of the ground or a strong chemical smell may indicate past spills at the plant; further investigation of spills may be warranted.
- Vital treatment units out of service for repairs. Determine when the units went out of service, the type of failure, and when they will be put back in service.
- Excessive noise from process or treatment.
- Any unusual equipment, intended to correct operation problems (e.g., special pumps, floating aerators in diffused air systems, chemical feeders, temporary construction or structures, or any improvised system).
- Ruptures in chemical feed lines.

Flow Indicators

- Surcharging of influent lines, overflow weirs, and other structures.
- Flow through bypass channels.
- Overflows at alternative discharge points, channels, or other areas.
- Excessive septage dumping by septic tank pumpers.

- Open-ended pipes that appear to originate in a process or storage area and periodically contain flows to the ground or to surface water. Although these pipes have been disconnected from a closed system or otherwise removed from service, they can still be connected to a discharge source.

Unusual Wastes Indicators

- Collected screenings, slurries, sludges, waste piles, or by-products of treatment. Their disposal, including runoff of any water, must be such that none enters navigable waters or their tributaries.
- No recycling of filtrates and supernatants from sludge beds.
- Improper storage of chemicals and hazardous substances with particular attention to the proper diking of chemicals and hazardous substances.
- Spills or mishandling of chemicals.

Preliminary Treatment

Screening

- Excessive screen clogging.

Shredding/Grinding

- Excessive build up of debris against screen
- Grit chamber clogged or subject to odors.

Grit Removal

- Excessive organic content of grit.

Primary Clarifier

General Indicators

- Excessive gas bubbles or grease on surface
- Black and odorous wastewater
- Poor suspended solids removal in primary clarifier
- Excessive buildup of solids in center well of circular clarifier
- Discharge weirs unlevel
- Evidence of short circuiting
- Scum rake ineffective
- Scum overflow or lack of adequate scum disposal, scum pit full
- Excessive floating sludge

- Excessive sludge on bottom, inadequate sludge removal
- Noisy sludge scraper drive
- Broken sludge scraper.

Secondary Biological Treatment Units

Trickling Filter

- Trickling filter ponding (indicating clogged media)
- Leak at center column of trickling filter's distribution arms
- Uneven distribution of flow on trickling filter surface
- Clogging of trickling filter's distribution arm orifices
- Restricted rotation of distribution arms
- Filter flies
- Ice buildup on trickling filter media or distribution arms.

Rotating Biological Contactors

- Development of white biomass on rotating biological contactor (RBC) media
- Excessive breakage of rotating disks or shafts in RBC units
- Excessive breakage of paddles on brush aerators
- Shaft, bearing, drive gear, or motor failure on disk or brush aerators.

Activated Sludge Tanks

- Dead spots in aeration tanks; dark foam or bad odor in aeration tanks
- Failure of surface aerators
- Inoperative air compressors
- Air rising in clumps
- Excessive air leaks in compressed air piping
- Dark mixed liquor in aeration tank
- Dark foam or bad odor on aeration tanks
- Stable dark tan foam on aeration tanks that sprays cannot break up
- Thick billows of white, sudsy foam on aeration tank
- Low Dissolved Oxygen (DO, < 1.0 mg/l) in aeration tank.

Stabilization Ponds

- Erosion of stabilization pond bank or dike
- Excessive weeds in stabilization ponds
- Foaming and spray in aerated lagoon
- Dead fish or aquatic organisms.

Secondary Clarifier

General Indicators

- Excessive gas bubbles on surface
- Fouling of overflow weirs
- Overflow weirs unlevel
- Evidence of short circuiting
- Excessive buildup of solids in center well of circular clarifier
- Deflocculation in clarifier
- Pin floc in overflow
- Scum rake ineffective
- Sludge floating to surface
- Billowing sludge
- Sludge blanket too high
- Sludge withdrawal ports on secondary clarifier clogged.

Advanced Physical Treatment Units

Filtration

- Filter surface clogging
- Short filter run
- Gravel displacement of filter media
- Formation of mud balls in filter media
- Air binding of filter media
- Loss of filter media during backwashing
- Recycled filter backwash water in excess of five percent.

Microscreening

- Erratic rotation of microscreen drums.

Activated Carbon Adsorption

- Excessive biological growth resulting in strong odor
- pH above 9.0
- Plugged carbon pores
- Presence of carbon fines (dust) in effluent.

Nitrification

- Hydraulic overload.

Denitrification

- Temperature below 15°C
- pH below 6.0°C or above 8.0°C
- Excessive methanol.

Ammonia Stripping

- Excessive hydraulic loading rate
- Tower packing coated with calcium carbonate
- pH below 10.8
- Inadequate tower packing depth
- Air temperature below 65°F.

Chlorination and Dechlorination Units

Chlorination

- Sludge buildup in contact chamber
- Gas bubbles noted
- Inadequate retention time
- Floating scum and/or solids
- Evidence of short circuiting
- Inadequate ventilation of chlorine feeding room and storage area
- High temperatures in chlorination rooms
- Improper operation of automatic feed or feedback control
- Excessive foaming downstream
- Evidence of toxicity downstream (dead fish, other dead organisms)
- Improper chlorine feed, storage, and reserve supply.

Dechlorination

- Improper storage of sulfur dioxide cylinders
- Inadequate ventilation of sulfur dioxide feeding room
- Automatic sulfur dioxide feed or feedback control not operating properly
- Depressed DO after dechlorination
- Proper storage and mixture of sodium metabisulfite containers
- Reduced efficiency of activated carbon dechlorination units because of organic and inorganic compound interference.

Sludge Handling

General Indicators

- Inadequate sludge removal from clarifiers or thickeners
- Poor dewatering characteristics of thermal treated sludge
- Thickened sludge too thin
- Fouling of overflow weirs on gravity thickeners
- Air flotation skimmer blade binding on beaching plate
- Substantial down time of heat treatment unit
- Sludge disposal inadequate to keep treatment system in balance.

Sludge Anaerobic Digestion

- Mechanical or gas mixers inoperative
- Sludge heater inoperative
- Floating cover of anaerobic digester tilting
- Inadequate gas production
- Gas burner not burning or inoperative
- Supernatant exuding a sour odor from either primary or secondary anaerobic digester
- pH problems from industrial wastewaters with high sugar content.

Sludge Aerobic Digestion

- Excessive foaming in tank
- Objectionable odor in aerobically digested sludge
- Insufficient DO in digester
- Digester overloaded
- Clogging of diffusers in digester
- Mechanical aerator failure in digester
- Inadequate supernatant removal from sludge lagoons
- Sludge lagoons full, overflowing sludge back to plant or to natural drainage.

Sludge Drying/Filtering

- Poor sludge distribution on drying beds
- Vegetation in drying beds
- Dry sludge remaining in drying beds
- Some drying beds unused
- Dry sludge stacked around drying beds where runoff may enter navigable waters

- Excessive drying time of sludge on drying bed
- Filtrate from sludge drying beds returned to front of plant
- Excessive solids in fluid phase of sample after centrifugation
- Inadequate dryness of centrifugal sludge cake
- High level of solids in filtrate from filter presses or vacuum filters
- Thin filter cake caused by poor dewatering
- Vacuum filter cloth binding
- Low vacuum on filter
- Improperly cleaned vacuum filter media
- Sludge buildup on belts and/or rollers of filter press
- Excessive moisture in belt filter press sludge cake
- Difficult cake discharge from filter presses
- Filter cake sticks to solids-conveying equipment of filter press
- Frequent media binding of filter press
- Sludge blowing out of filter press
- Insufficient run time of sludge dewatering equipment
- Objectionable odor from sludge lagoon
- Broken dikes between sludge drying lagoons
- Unlined sludge lagoons.

Sludge Disposal

- Sludge constituents not analyzed before disposal
- Sludge not transported in appropriate and approved vehicle
- Surface runoff of sludge at land application site
- Liquid sludge (i.e., less than 10 percent solids) applied to landfill site
- Inadequate coverage of sludge in subsurface plow injection system
- Malodors generated at land application site
- Slow drying of soil-sludge mixture in subsurface injection system
- Sludge ponding at land application sites
- Flies breeding and/or odors at landfill site
- Inadequate burial of sludge at landfill site
- Excessive erosion at sludge sites
- Waste sludges disposed on-site in nonpermitted sites or in landfills, surface impoundments, or land application units not according to Federal, State, or local regulations
- Inadequate runoff control at landfill or land application sites.

Polishing Ponds or Tanks

- Objectionable odor, excessive foam, floating solids, or oil sheens in polishing ponds or tanks
- Solids or scum accumulations in tank or at side of pond
- Evidence of bypassed polishing ponds or tanks because of low capacity.

Plant Effluent

- Excessive suspended solids, turbidity, foam grease, scum, color, and other macroscopic particulate matter present
- Potential toxicity (dead fish, dead plants at discharge).

Flow Measurement

- Flow totalizer not calibrated
- Buildup of solids in flume or weir
- Broken or cracked flume or weir
- Magnetic flowmeter not functioning properly
- Stilling wells clogged or broken
- Weir plate edge corroded or damaged, not sharp edged ($\leq$ 1/8"), or not level
- Incapable of measuring maximum flow
- Sizing of system adequate to handle flow range.

Chemical Treatment Units

- Heavy corrosion evident
- No portion-measuring device at feed unit
- pH measuring not evident at pH adjustment tank
- Chemicals left in open atmosphere
- Chemicals outdated
- Chemical containers stored improperly or hazardously
- Chemical tanks cars (trucks or train) stored, moved, or handled inappropriately
- Dry chemicals spilled on floor between storage area and feed units
- Empty chemical containers improperly disposed of
- Large containers handled improperly, container transfer equipment not maintained
- No appropriate sized berms or dikes at liquid chemical feed units
- Inadequate supply of chemicals
- Chemical dust covering feed unit area or storage and transfer areas
- Use of an inappropriate coagulant
- Glass carboys (acid storage) stored or handled improperly.

General Housekeeping

- Facility control panel in disrepair or not in use
- Wastewater pipelines not clearly distinguished from product pipelines.

Production Changes

Industries frequently make production changes because of advances in technology and availability of new products. Therefore, during the tour of an industrial facility, the inspector also should inquire:

- Whether a permittee has made any changes to:

  - Production processes
  - Raw materials
  - Amount of finished product
  - Water use
  - Waste treatment processes
  - Other such changes

- Whether the permittee has modified any production process that would change the pollutant loading
- Whether the regulatory agency was notified of such changes
- What changes will need to be reflected in any National Pollutant Discharge Elimination System (NPDES) permit modifications.

The inspector should verify any changes and include the results of the findings and other pertinent information in the Compliance Inspection Report. Changes in the loading to Publicly Owned Treatment Works (POTWs) by the addition of a significant industrial discharger or large population growth also should be ascertained and reported.

C OPERATION AND MAINTENANCE EVALUATION

Operation Evaluation

Operating factors affecting plant performance range from qualitative factors such as the skills and aptitudes of operators (e.g., process knowledge and general aptitude), to physical deficiencies in laboratory equipment or a lack of flexibility in process equipment. The evaluation of operation functions must focus on wastewater treatment, sludge treatment/ disposal, and laboratory analysis. The evaluation should be based on the following topics:

- Policies and procedures
- Organization
- Staffing
- Planning
- Management controls.

Table 4-1 presents the basic review questions that an inspector should ask in evaluating operation functions. Although each of the preceding evaluation topics must be covered in the review of operation functions, the following four areas should particularly concern the inspector:

Policies and Procedures

Written operating procedures and standard reference texts enable the operator to achieve efficient plant operation. The operations manual prepared for the facility is the most important reference that an inspector should review when evaluating plant policies and procedures. Other reference materials relating to operations that should be available to the operator include manufacturers' literature, publications by professional organizations (e.g., the Water Pollution Control Federation), and EPA publications.

Staffing

Even the best engineered facility cannot perform to its potential without a sufficient number of capable and qualified staff. The inspector must consider the abilities and limitations of the operating staff. Staff inter-

views may include the individual in charge of overall operation, the chief operator, specific unit process operators, and laboratory staff.

Health and Safety

At all times, safe operating procedures should be followed. Employees must be trained in emergency shut-down, fire control, and spill response procedures, as well as in the use of safety equipment, safe sampling techniques, and the safe handling of chemicals and wastes. Managers must be aware of the OSHA Right-to-Know laws regarding potentially dangerous chemicals in the workplace. This law specifically requires a written hazard communication program, labeling of chemicals, and the availability of material safety data sheets to employees upon request.

Management Controls

Monitoring practices are a good indicator of both the emphasis placed on operations and the operator's understanding of process controls. Factors affecting a facility's monitoring capabilities are:

- The sampling program
- Performance testing
- Analytical capabilities
- Recordkeeping practices.

An effective process control program is essential to a treatment facility's optimal performance. However, process control cannot be easily quantified by the inspector. In most cases, the inspector must rely on discussions with the plant superintendent and/or operators to supplement available records and the technical evaluation. The key considerations for effective process controls are:

- Process control data
- Process knowledge of the operators
- The basis for the control practices
- Implementation of the control practices
- Past performance
- Operator emphasis on controls
- Recordkeeping.

Maintenance Evaluation

Facility maintenance directly affects the ability of the facility to run efficiently and to comply with its NPDES permit. The two types of facility maintenance are:

- Preventive maintenance

  - Reduces facility operating costs by eliminating breakdowns and the need for corrective maintenance

- Improves the facility's reliability by minimizing the time equipment is out of service
- Increases the useful life of equipment, thus, avoiding costly premature replacement
- Avoids possible compliance violations

- Corrective maintenance

  - Returns malfunctioning equipment to operation
  - Avoids or minimizes possible compliance violations.

Evaluation of the maintenance function must focus on the ability to maintain process equipment, vehicles, and building and grounds. Although each of the five evaluation topics (policies and procedures, organization, staffing, planning, and management controls) must be covered for each facility inspected, the principal areas of concern in the operations evaluation are the same in the maintenance function:

- Staffing and training
- Planning and scheduling
- Management control--records systems and inventory control.

Only well-trained, competent plant staff can be expected to perform adequate physical inspections, repairs, and preventive maintenance. Wastewater facility maintenance is complex and requires a variety of skills. Because many of these skills are not readily available, an ongoing training program is essential.

Maintenance planning and scheduling is essential to effective corrective and preventive maintenance. The maintenance supervisor must prepare work schedules listing job priorities, work assignments, available personnel, and timing.

A detailed records system is the basis of any maintenance program. Records are used to establish maintenance histories on equipment, diagnose problems, and anticipate--and thereby avoid--equipment failure, making records an effective tool for preventive maintenance.

A central inventory of spare parts, equipment, and supplies must be maintained and controlled. The basis for the inventory should be the equipment manufacturer's recommendations, supplemented by specific, historical experience with maintenance problems and requirements. Inventoried supplies must be kept at levels sufficient to avoid process interruptions.

A maintenance cost control system should be an integral part of every wastewater facility. Budgets must be developed from past cost records and usually are categorized according to preventive maintenance, corrective maintenance, and projected and actual major repair requirements. Annual costs must be compared to the budget periodically to control maintenance expenditures. Evaluating costs this way serves to control expenditures and as a baseline for future budgets.

The basic concerns that need to be addressed and evaluated during the inspector's maintenance program review are presented at the end of this section in Table 4-1.

Table 4-1

Operations and Maintenance Function Evaluation Questions

Policies and Procedures

- Is there a formal or informal set of policies for facility operations?
- Do policies address:
  - Remaining in compliance
  - Maintaining process controls
  - Quality control
  - Preventive maintenance?
- Is there a set of standard procedures to implement these policies?
- Are the procedures written or informal?
- Do the procedures consider the following areas:
  - Safety
  - Emergency
  - Laboratory
  - Process control
  - Operating procedures
  - Monitoring
  - Labor relations
  - Energy conservation
  - Collection system
  - Pumping stations
  - Treatment process
  - Sludge disposal
  - Equipment record system
  - Maintenance planning and scheduling
  - Work orders
  - Inventory management?
- Are the procedures followed?

Organization

- Is there an Organizational Plan (or Chart) for operations?
- Does the Plan include:
  - Delegation of responsibility and authority
  - Job descriptions
  - Interaction with other functions (such as maintenance)?

Table 4-1

Operations and Maintenance Function Evaluation Questions (Continued)

- Is the Plan formal or informal?
- Is the Plan available to and understood by the staff?
- Is the Plan followed?
- Is the Plan consistent with policies and procedures?
- Is the Plan flexible? Can it handle emergency situations?
- Does the Plan clearly define lines of authority and responsibility in such subfunctional areas as:

  - Laboratory
  - Process control
  - Instrumentation
  - Sludge disposal
  - Collection system
  - Pumping stations
  - Monitoring practices
  - Mechanical
  - Electrical
  - Buildings and grounds
  - Automotive
  - Supplies and spare parts?

Staffing

- Is there an adequate number of staff to achieve policies and procedures?
- Are staff members adequately qualified for their duties and responsibilities by demonstrating:

  - Certification
  - Qualifications
  - Ability
  - Job performance
  - Understanding of treatment processes?
- Is staff effectively used?
- Has the potential for borrowing personnel been considered?
- Are training procedures followed for:

  - Orientation of new staff
  - Training new operators
  - Training new supervisors
  - Continuing training of existing staff
  - Cross training?

Table 4-1

Operations and Maintenance Function Evaluation Questions (Continued)

- Which of the following training procedures are used:

  - Formal classroom
  - Home study
  - On-the-job training
  - Participation in professional organization

- Does the training program provide specific instruction for the following operations and maintenance activities:

  - Safety
  - Laboratory procedures
  - Treatment processes
  - Instrumentation
  - Equipment troubleshooting
  - Handling personnel problems
  - Monitoring practices
  - Handling emergencies
  - Mechanical
  - Electrical
  - Automotive
  - Building maintenance
  - Inventory control?

- Does management encourage staff motivation?

- Does management support its first-line supervisors?

- Is staff motivation maintained with:

  - Encouragement for training
  - Job recognition
  - Promotional opportunities
  - Salary incentives
  - Job security
  - Working environment?

Operations

- How are operating schedules established?

- Do schedules attempt to attain optimum staff utilization?

- Are line supervisors included in manpower scheduling?

- Are staff involved in and/or informed of manpower planning?

- Is there sufficient long-term planning for staff replacement and system changes?

- Are there procedures in manpower staffing for emergency situations?

- How are process control changes initiated?

Table 4-1

Operations and Maintenance Function Evaluation Questions (Continued)

- How do process control changes interact with management controls?
- How effectively are laboratory results used in process control?
- Are there emergency plans for treatment control?
- Is there an effective energy management plan? Is the plan used?
- To what extent are operations personnel involved in the budget process?
- Do budgets adequately identify and justify the cost components of operations?
- Are future budgets based on current and anticipated operating conditions?
- Do operating and capital budget limits constrain operations?
- Can budget line items be adjusted to reflect actual operating conditions?

Maintenance

- Are maintenance activities planned? Is the planning formal or informal?
- Does the facility have sufficient management controls to affect realistic planning and scheduling? If the controls exist, are they used?
- Are operating variables exploited to simplify maintenance efforts?
- To what extent are the supply and spare part inventories planned in conjunction with maintenance activities?
- Have minimum and maximum levels been established for all inventory items?
- Does the facility have a maintenance emergency plan?
- Is the maintenance emergency plan current? Is the staff knowledgeable about emergency procedures?
- Does a plan exist for returning to the preventive maintenance mode following an emergency?

Table 4-1

Operations and Maintenance Function Evaluation Questions (Continued)

- Are preventive maintenance tasks scheduled in accordance with manufacturer's recommendations?
- Is adequate time allowed for corrective maintenance?
- Are basic maintenance practices (preventive and corrective) and frequencies reviewed for cost-effectiveness?
- Do the management controls provide sufficient information for accurate budget preparation?
- Does the maintenance department receive feedback on cost performance to facilitate future budget preparation?
- To what extent are maintenance personnel involved in the budget process?
- Do budgets adequately identify and justify the cost components of maintenance?
- Are future budgets based on current and anticipated operating and maintenance conditions?
- Do maintenance and capital budget limits constrain preventive maintenance (equipment replacement and improvements)?
- Does the maintenance department receive adequate feedback on cost performance?
- Can budget line items be adjusted to reflect actual maintenance conditions?

Management Controls

- Are current versions of the following documents maintained:

  - Operating reports
  - Work schedules
  - Activity reports
  - Performance reports (labor, supplies, energy)
  - Expenditure reports (labor, supplies, energy)
  - Cost analysis reports
  - Emergency and complaint calls
  - Process control data, including effluent quality?

- Do the reports contain sufficient information to support their intended purpose?

Table 4-1

Operations and Maintenance Function Evaluation Questions (Continued)

- Are the reports usable and accepted by the staff?
- Are the reports being completed as required?
- Are the reports consistent among themselves?
- Are the reports used directly in process control?
- Are the reports reviewed and discussed with operating staff?
- What type of summary reports are required?
- To whom are reports distributed and when?

Management Controls (Maintenance)

- Does a maintenance record system exist? Does it include:

  - As-built drawings
  - Shop drawings
  - Construction specifications
  - Capital and equipment inventory
  - Maintenance history (preventive and corrective)
  - Maintenance costs?

- Is the base record system kept current as part of daily maintenance practices?
- Is there a work order system for scheduling maintenance? Is it explicit or implicit?
- Do work orders contain:

  - Date
  - Work order number
  - Location
  - Nature of problem
  - Work requirements
  - Time requirements
  - Assigned personnel
  - Space for reporting work performed, required supplies, time required, and cost summary
  - Responsible staff member and supervisory signature requirements?

- When emergency work must be performed without a work order, is one completed afterward?
- Are work orders usable and acceptable by staff as essential to the maintenance program? Are they actually completed?

Table 4-1

Operations and Maintenance Function Evaluation Questions (Continued)

- Is work order information transferred to a maintenance record system?
- Does a catalog or index system exist for controlling items in inventory?
- Are withdrawal tickets used for obtaining supplies from inventory?
- Do the tickets contain cost information and interact well with inventory controls and the work order system?
- Is the cost and activity information from work orders aggregated to provide management reports? Is this information also used for budget preparation?
- Is the maintenance performance discussed regularly with staff?
- How is the cost of contract maintenance or the use of specialized assistance recorded?
- Are safeguards and penalties adequate to prevent maintenance cards from being returned without the work being done?
- Is the preventive maintenance record checked after an emergency equipment failure?

D REFERENCES AND FACILITY SITE REVIEW CHECKLIST

References

U.S. Environmental Protection Agency. 1973. Maintenance Management Systems for Municipal Wastewater Facilities. EPA 430/9-74-004.

U.S. Environmental Protection Agency. 1978. Field Manual for Performance Evaluation and Troubleshooting at Municipal Wastewater Treatment Facilities. MO No. 16, EPA 430/9-78-001.

U.S. Environmental Protection Agency. 1979. Inspector's Guide for Evaluation of Municipal Wastewater Treatment Plants. EPA 430/9-79-010.

U.S. Environmental Protection Agency. 1982. Comprehensive Diagnostic Evaluation and Selected Management Issues. EPA 430/9-82-003.

Water Pollution Control Federation (WPCF). 1977. Operation of Wastewater Treatment Plants. MOP No. 11, WPCF, 1977.

Water Pollution Control Federation (WPCF). 1977. Wastewater Treatment Plant Design. MOP No. 8, WPCF, 1977.

FACILITY SITE REVIEW CHECKLIST

A. OPERATION AND MAINTENANCE EVALUATION

Yes No N/A	1. Treatment units properly operated and maintained.
Yes No N/A	2. Standby power or other equivalent provision provided.
Yes No N/A	3. Adequate alarm system for power or equipment failures available.
	4. Sludge disposal procedures appropriate:
Yes No N/A	a. Disposal of sludge according to regulations
Yes No N/A	b. State approval for sludge disposal received.
Yes No N/A	5. All treatment units, other than backup units, in service.
Yes No N/A	6. Procedures for facility operation and maintenance followed.
Yes No N/A	7. Sufficient sludge disposed of to maintain treatment process equilibrium.
Yes No N/A	8. Organizational Plan (chart) for operation and maintenance provided.
Yes No N/A	9. Operating schedules established.
Yes No N/A	10. Emergency plan for treatment control established.
	11. Maintenance record system exists and includes:
Yes No N/A	a. As-built drawings
Yes No N/A	b. Shop drawings
Yes No N/A	c. Construction specifications
Yes No N/A	d. Maintenance history
Yes No N/A	e. Maintenance costs
Yes No N/A	f. Repair history
Yes No N/A	g. Records of equipment repair and timely return to service.
Yes No N/A	12. Adequate number of qualified operators on-hand.
Yes No N/A	13. Established procedures available for training new operators.
Yes No N/A	14. Adequate spare parts and supplies inventory maintained.
Yes No N/A	15. Instruction files kept for operation and maintenance of each item of major equipment.
Yes No N/A	16. Operation and maintenance manual available.
Yes No N/A	17. Regulatory agency notified of bypassing. (Dates_____)
Yes No N/A	18. a. Hydraulic overflows and/or organic overloads experienced.
Yes No N/A	b. Untreated bypass discharge occurs during power failure.
Yes No N/A	c. Untreated overflows occurred since last inspection. Reason: _____
Yes No N/A	d. Flows observed in overflow or bypass channels.
Yes No N/A	e. Checking for overflows performed routinely.
Yes No N/A	f. Overflows reported to EPA or to the appropriate State agency as specified in the permit.

FACILITY SITE REVIEW CHECKLIST
(Continued)

B. SAFETY EVALUATION

Yes No N/A	1. Undiked oil/chemical storage tanks used at facility.
Yes No N/A	2. Up-to-date equipment repair records maintained.
Yes No N/A	3. Dated tags show out-of-service equipment.
Yes No N/A	4. Routine and preventive maintenance scheduled/performed on time.
Yes No N/A	5. Personal protective clothing provided (safety helmets, ear protectors, goggles, gloves, rubber boots with steel toes, eyewashes in labs).
	6. Safety devices readily available:
Yes No N/A	a. Fire extinguishers
Yes No N/A	b. Oxygen deficiency/explosive gas indicator
Yes No N/A	c. Self-contained breathing apparatus near entrance to chlorine room
Yes No N/A	d. Safety harness
Yes No N/A	e. First aid kits
Yes No N/A	f. Ladders to enter manholes or wetwells (fiberglass or wooden for electrical work)
Yes No N/A	g. Traffic control cones
Yes No N/A	h. Safety buoy at activated sludge plants
Yes No N/A	i. Life preservers for lagoons
Yes No N/A	j. Fiberglass or wooden ladder for electrical work
Yes No N/A	k. Portable crane/hoist.
Yes No N/A	7. Plant has general safety structures such as rails around or covers over tanks, pits, or wells.
Yes No N/A	8. Emergency phone numbers listed.
Yes No N/A	9. Plant is generally clean, free from open trash areas.
Yes No N/A	10. Portable hoists, for equipment removal, available.
Yes No N/A	11. All plant personnel immunized for typhoid and tetanus.
Yes No N/A	12. No cross connections exist between a potable water supply and nonpotable source.
Yes No N/A	13. Gas/explosion controls such as pressure-vacuum relief values, no smoking signs, explosimeters, and drip traps present near anaerobic digesters, enclosed screening or degritting chambers, and sludge-piping or gas-piping structures.
Yes No N/A	14. All electrical circuitry enclosed and identified.
Yes No N/A	15. Personnel trained in electrical work to be performed as well as safety procedures.
	16. Chlorine safety:
Yes No N/A	a. NIOSH-approved 30-minute air pack
Yes No N/A	b. All standing chlorine cylinders chained in place
Yes No N/A	c. All personnel trained in the use of chlorine
Yes No N/A	d. Chlorine repair kit available
Yes No N/A	e. Chlorine leak detector tied into plant alarm system

FACILITY SITE REVIEW CHECKLIST
(Continued)

Yes No N/A	f. Ventilation fan with an outside switch
Yes No N/A	g. Posted safety precautions.
Yes No N/A	17. Facility has complied with the six employer responsibilities for the Worker Right-to-Know Law (P.A. 83-240).
Yes No N/A	18. Emergency Action Plan on file with local fire department and appropriate emergency agency.
Yes No N/A	19. Laboratory safety devices (eyewash and shower, fume hood, proper labeling and storage, pipette suction bulbs) available.
Yes No N/A	20. Warning signs (no smoking, high voltage, non potable water, chlorine hazard, watch-your-step, and exit) posted.

Chapter Five

SAMPLING

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Chapter Five

A EVALUATION OF PERMITTEE SAMPLING PROGRAM AND COMPLIANCE SAMPLING

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 40 CFR Parts 136.1 to 136.4 and Appendices A, B, and C (Guidelines for Establishing Test Procedures for the Analysis of Pollutants)
- Document violations to support enforcement action.

In addition, specific objectives of the sampling conducted by inspectors includes the following:

- Verify compliance with daily maximum 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.

Refer to Chapter Seven for requirements of biomonitoring compliance sampling. 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). More information on required analytical procedures can be found under "Laboratory Analyses Techniques Evaluaton" in Chapter Eight. A checklist for use in evaluating the permittee's sampling program is located at the end of this chapter.

For all NPDES permittees, an evaluation of the permittee sampling program should include a review of sampling procedures used by the facility and of quality control measures used to ensure the integrity of sample data.

Evaluation of sampling procedures should include an assessment of the following six areas:

- Sample collection techniques
- Sample identification
- Sample preservation and holding time
- Transfer of custody and shipment of samples
- Quality control
- Data handling and reporting.

Significant Industrial User Monitoring Program

It is the responsibility of the permitted Publicly Owned Treatment Works (POTW) with a pretreatment program to oversee sampling procedures of industrial users and to conduct compliance monitoring of its own. Therefore, in addition to evaluating the sampling procedures of any permitted POTW (discussed above), the inspector may also need to evaluate POTW sampling procedures for signficant industrial users who discharge to the POTW. During a Pretreatment Compliance Inspection (PCI) or an audit, the inspector evaluates the POTW industrial user monitoring program with respect to the criteria specified in the POTW pretreatment program. Elements of the sampling scheme will include the six areas addressed above and any other areas specifically addressed in the particular pretreatment program. Chapter Nine, "Pretreatment," discusses the focus of this evaluation in greater detail.

B SAMPLING PROCEDURES AND TECHNIQUES

Whether an inspector is evaluating a permittee's sampling program or conducting compliance sampling on the permittee's effluent, he/she must be familiar with the procedures and techniques necessary for accurate sampling of wastewaters. The following discussion details the procedures for sample collection, preservation, transfer, quality control, and data handling.

Sample Collection Techniques

Sample collection is an important part of the compliance monitoring program. Without proper sample collection procedures, the results of such monitoring programs are neither useful nor valid, even with the most precise and accurate analytical measurements.

Selection of Representative Sampling Sites

Samples should be collected at the location specified in the permit. In some instances, the sampling location specified in the permit or the location chosen by the permittee may not be adequate for the collection of a representative sample. In that case, the inspector should determine the most representative sampling point available and collect a sample at both locations. The reason for the conflict must be documented for later resolution by the permitting authority.

Influent Samples. These samples should be taken at points of high-turbulence flow to ensure good mixing. In some instances, the most desirable location may not be accessible. Sampling points always should be above plant 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:

- Waste flowing from last process in a manufacturing operation
- Pump wet well (if turbulent)
- Upflow collection lines, tank, or distribution box following pumping from the wet well or sump
- Flume throat

- Aerated grit chamber
- Upflow siphon following the comminutor (in absence of grit chamber).

If it is not possible to sample at a preferred point, an alternative location should be chosen and the basis for choosing that location must be documented.

Effluent Samples. These samples should be collected at the site specified in the permit or, if no site is specified in the permit, at the most representative site downstream from all entering wastestreams before they enter the receiving waters. For some municipal plants, samples should be collected after chlorination. This will require dechlorination and reseeding for the Biochemical Oxygen Demand (BOD_5) analysis. Other municipal plant permits specify sampling prior to chlorination. For these plants, all parameters can be monitored at the upstream location except coliforms. Wastewater for use in bioassays should be collected prior to chlorination.

Samples can be collected either manually (grab or composite) or with automatic samplers (continuous or composite). The following general guidelines apply when taking samples:

- Take samples at a site specified in the NPDES permit and/or at a site selected to yield a representative sample.

- Use a sampling method (grab, composite, continuous) as required in the sampling and analysis methods of 40 CFR Part 136. Some parameters that are not to be sampled by automatic samplers, but must be hand collected samples, include the following: dissolved oxygen, total residual chlorine, pH, temperature, oil and grease, coliforms, purgeable organics, and sulfides.

- 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 it 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. (Table 5-1 provides a guide to numerous sample volumes but additional volumes may be necessary for quality assurance testing.)

Sample Types

Two types of sample techniques are used: grab and composite. For many monitoring procedures, the sample type is not specified in 40 CFR Part

136. For these procedures, the NPDES permit writer determines the appropriate sample type and these are specified in the NPDES permit.

Grab Samples. Grab samples are individual samples collected over a period of time not exceeding 15 minutes. Grab samples can be taken manually. The sample volume depends on the number of analyses to be performed but a minimum of 2 gallons is recommended for a grab sample and many analyses require a sample volume of approximately 100 ml. The collection of a grab sample is appropriate when a sample is needed to:

- Provide information about instantaneous concentrations of pollutants at a specific time
- Allow collection of a variable sample volume
- Corroborate composite samples if waste is not highly variable
- Monitor parameters not amenable to compositing (e.g., pH, temperature, dissolved oxygen, chlorine, purgeable organics and sulfides, oil and grease, coliform bacteria and others specified by the NPDES permit which may include cyanide, phenols, sulfites, hexavalent chromium, and phosphorus.)

Composite Samples. These samples consist of an appropriate number of discrete samples collected at equal intervals and combined in proportion to flow, a sample continuously collected in proportion to flow, or equal volumes taken at varying time intervals in proportion to flow. A larger number of discrete samples may be required when flows are highly variable. Composite samples are used when stipulated in a permit and when:

- Determining average pollutant concentration during the compositing period
- Calculating mass/unit time loadings
- Wastewater characteristics are highly variable.

Both discreet and composite samples can be collected either manually or with automatic samplers. Variability in wastestream flow rate and parameter concentrations should be considered carefully when choosing compositing methods, sampling equipment (tubing and containers), and quality assurance procedures.

Compositing samples can be continuous or periodic. There are three predominant methods for compositing samples which are shown in Table 5-2. In any manual compositing method, sample handling should be minimized to reduce the possibility of contamination.

Sample Volume

The volume of samples collected depends on the type and number of analyses needed, as reflected in the parameters to be measured. The volume of the sample obtained should be sufficient for all the required analyses plus an additional amount to provide for any split samples or repeat analyses. Table 5-1 provides a guide to sample volumes required for determining the constituents in wastewater. The laboratory receiving the sample should be consulted for any specific volume required. Specific recommended minimum sample volumes for different pollutant parameters can be found in EPA's Methods for Chemical Analysis of Water and Wastes (USEPA 1979b)

and Handbook for Sampling and Sample Preservation of Water and Wastewater (USEPA 1982), and the current EPA-approved edition of Standard Methods (APHA, AWWA, and WPCF).

Sample Containers

Required sample containers, sample container preparation, and sample holding techniques are contained in 40 CFR Part 136. A table including this material is provided in Table 5-3. 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. Wastewater samples for chemical analysis generally are collected in plastic (polyethylene) containers. Exceptions to this general rule are oil and grease samples, pesticides, phenols, polychlorinated biphenyls (PCBs), and other organic pollutant samples. These are collected in properly rinsed glass jars or bottles and sealed. Bacteriological samples always are collected in properly sterilized plastic or glass containers.

EPA Sample Identification Methods

Each sample must be accurately and completely identified. Any label used to identify the sample must be moisture-resistant and able to withstand field conditions. A numbered label associated with a field sample data sheet containing detailed information on the sample is preferable to using only a label for information. The information provided for each sample should include the following:

- Facility name/location
- Sample site description
- Sample number
- Signature/initials of collector for each sample
- Date and time of collection
- Indication of grab or composite sample with appropriate time and volume information
- Identification of parameter to be analyzed
- Preservative used
- Indication of any unusual condition at the sampling location and/or in the appearance of the wastewater
- Notation of conditions such as pH, temperature, residual chlorine, and appearance that may change before the laboratory analysis, including the identification numbers of instruments used to measure parameters in the field.

Sample Preservation and Holding Time

In most cases, wastewater samples contain one or more unstable pollutants that require immediate preservation and/or analysis. Appropriate chemical preservation should be provided before samples are transferred to the

laboratory. Procedures used to preserve samples include icing, refrigeration, pH adjustment, and chemical treatment. For some parameters such as cyanide and phenol, preservatives must be added to sample bottles prior to 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 cyanide and sulfides) or may react to form different chemical species (hexavalent chromium, for example). Proper preservation and holding time for each parameter of a sample is essential to the integrity of the monitoring program. (See Table 5-3 and refer to 40 CFR Part 136.)

Prompt analysis is the most positive assurance against error from sample deterioration, but this is not feasible for composite samples in which portions may be stored for as long as 24 hours. Where possible, sample preservation must be provided during compositing, generally by refrigeration to 4°C (or icing). If an automatic sampler is used with ice, the ice must be replaced as necessary to maintain low temperatures. This is a particular limitation of automatic samplers used during the summer when ice must be frequently replaced.

Transfer of Custody and Shipment 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. The primary objective of this chain-of-custody is to create an accurate written record (see Figure 5-1, an example chain-of-custody form) 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.

- Samples should be packed properly to prevent breakage. The shipping container should be sealed or locked so that any evidence of tampering may be readily detected. Use of tamperproof evidence tape is recommended.

- Every sample must be accompanied by either a chain-of-custody tag or a chain-of-custody record that has been completed, signed, and dated.

- The responsibility for proper packaging, labeling, and transferring of possession of the sample lies with the person taking it.

- All sample shipments must be accompanied by the chain-of-custody record and other pertinent forms. A copy of these forms should be retained by the originator. Also, all receipts associated with the shipment should be retained.

- 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. Each person who takes custody must fill in the appropriate section of the chain-of-custody record.

Quality Control

Control checks should be performed during the actual sample collection to determine the performance of sample collection techniques. In general, the most common monitoring errors usually are caused by improper sampling, improper preservation, inadequate mixing during compositing and splitting, and excessive sample holding time. The following samples should be used to check sample collection techniques:

- Duplicate samples are separate samples taken from the same source at the same time. These samples provide a check on sampling equipment and precision techniques.

- 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.

- Spiked samples are samples to which a known quantity of substance has been added. They provide a way to verify the accuracy of the analytical procedures.

- Sample preservative blanks are samples of distilled water to which a known quantity of preservative is added. They are analyzed to determine the effectiveness of the preservative, providing a check on the contamination of chemical preservatives.

Quality control is discussed in greater detail in Chapter Eight of this manual.

Data Handling and Reporting

Verified analytical results are normally entered into a laboratory data management system of some type, which should include sampling data, including time and exact location, analysis dates and time, names of analysts, analytical methods/techniques used, and analytical results. Data are then reported to the project officer (inspector) for inclusion into the compliance report. The quality assurance manual by EPA (Handbook for Analytical Quality Control in Water and Wastewater Laboratories, USEPA 1979) and the article by J.J. Delfino ("Quality Assurance in Water and Wastewater Analysis Laboratories," Delfino 1977) provide useful information to the inspector on a number of data management techniques.

Table 5-1

Volume of Sample Required for Determination of the Various Constituents of Industrial Wastewater (Associated Water and Air Resource Engineers, Inc. 1973 Handbook for Monitoring Industrial Wastewater. USEPA Technology Transfer.)

Tests	Volume of Sample,(1) ml
PHYSICAL	
Color and Odor(2)	100 to 500
Corrosivity(2)	flowing sample
Electrical conductivity(2)	100
pH, electrometric(2)	100
Radioactivity	100 to 1,000
Specific gravity(2)	100
Temperature(2)	flowing sample
Toxicity(2)	1,000 to 20,000
Turbidity(2)	100 to 1,000
CHEMICAL	
Dissolved Gases:	
Ammonia,(3) NH(3)	500
Carbon dioxide,(3) free CO_2	200
Chlorine,(3) free Cl_2	200
Hydrogen,(3) H_2	1,000
Hydrogen sulfide,(3) H_2S	500
Oxygen,(3) O_2	500 to 1,000
Sulfur dioxide,(3) free SO_2	100
Miscellaneous:	
Acidity and alkalinity	100
Bacteria, iron	500
Bacteria, sulfate-reducing	100
Biochemical oxygen demand (BOD)	100 to 500
Carbon dioxide, total CO_2 (including CO_3^{--}, HCO_3^-, and free)	200
Chemical oxygen demand (dichromate)	50 to 100
Chlorine requirement	2,000 to 4,000
Chlorine, total residual Cl_2 (including OCl^-, HOCl, NH_2Cl, $NHCl_2$, and free)	200
Chloroform-extractable matter	1,000
Detergents	100 to 200
Hardness	50 to 100
Hydrazine	50 to 100
Microorganisms	100 to 200
Volatile and filming amines	500 to 1,000
Oily matter	3,000 to 5,000
Organic nitrogen	500 to 1,000
Phenolic compounds	800 to 4,000
pH, colorimetric	10 to 20

Table 5-1

Volume of Sample Required for Determination of the Various Constituents of Industrial Wastewater (Continued)

Tests	Volume of Sample,(1) ml
Miscellaneous:	
Polyphosphates	100 to 200
Silica	50 to 1,000
Solids, dissolved	100 to 20,000
Solids, suspended	50 to 1,000
Tannin and lignin	100 to 200
Cations:	
Aluminum, Al^{+++}	100 to 1,000
Ammonium,(3) NH_4^+	500
Antimony, Sb^{+++} to Sb^{+++++}	100 to 1,000
Arsenic, As^{+++} to As^{+++++}	100 to 1,000
Barium, Ba^{++}	100 to 1,000
Cadmium, Cd^{++}	100 to 1,000
Calcium, Ca^{++}	100 to 1,000
Chromium, Cr^{+++} to Cr^{++++++}	100 to 1,000
Copper, Cu^{++}	200 to 4,000
Iron,(3) Fe^{++} and Fe^{+++}	100 to 1,000
Lead, Pb^{++}	100 to 4,000
Magnesium, Mg^{++}	100 to 1,000
Manganese, Mn^{++} to $Mn^{+++++++}$	100 to 1,000
Mercury, Hg^+ and Hg^{++}	100 to 1,000
Potassium, K^+	100 to 1,000
Nickel, Ni^{++}	100 to 1,000
Silver, Ag^+	100 to 1,000
Sodium, Na^+	100 to 1,000
Strontium, Sr^{++}	100 to 1,000
Tin, Sn^{++} and Sn^{++++}	100 to 1,000
Zinc, Zn^{++}	100 to 1,000
Anions:	
Bicarbonate, HCO_3^-	100 to 200
Bromide, Br^-	100
Carbonate, CO_3^{--}	100 to 200
Chloride, Cl^-	25 to 100
Cyanide, Cn^-	25 to 100
Fluoride, Fl^-	200
Hydroxide, OH^-	50 to 100
Iodide, I^-	100
Nitrate, NO_3^-	10 to 100
Nitrite, NO_2^{--}	50 to 100
Phosphate, ortho, PO_4^{--}, HPO_4^{--}, $H_2PO_4^-$	50 to 100

Table 5-1

Volume of Sample Required for Determination of
the Various Constituents of Industrial Wastewater (Continued)

Tests	Volume of Sample,(1) ml
Sulfate, SO_4^{--}, HSO_4^-	100 to 1,000
Sulfide, S^{--}, HS^-	100 to 500
Sulfite, SO_3^{--}, HSO_3^-	50 to 100

(1)Volumes specified in this table should be considered as guides for the approximate quantity of sample necessary for a particular analysis. The exact quantity used should be consistent with the volume prescribed in the standard method of analysis, whenever a volume is specified.
(2)Aliquot may be used for other determinations.
(3)Samples for unstable constituents must be obtained in separate containers, preserved as prescribed, completely filled, and sealed against all exposure.

Table 5-2

Compositing Methods (1)

Compositing Principle	Advantages	Disadvantages	Comments
Volume Constant Equal Time Interval (2)	Minimal instrumentation and manual effort; requires no flow measurement	May lack representativeness, especially for highly variable flows	Widely used in automatic as well as manual sampling
Volume Constant Variable Time Interval	Minimal manual effort	Requires accurate flow measurement/ reading equipment; manual compositing from flow chart or totalizer; does not allow for large variations in flow	Widely used in automatic sampling and sometimes used in manual sampling
Volume Variable Equal Time Interval	Minimal instrumentation	Manual compositing from flow chart. Chance of collecting either too small or too large individual discrete samples for a given composite volume	Widely used as manual method and sometimes used in automatic samplers

(1) For more detailed information, please refer to Table 2-5 of the Handbook for Sampling and Sample Preservations (EPA 1982), pages 20 and 21.

(2) Not acceptable as flow-weighted composite when flow rates vary by more than 15 percent during the compositing period.

Table 5-3

Required Containers, Preservation Techniques, Holding Times, and Test Methods
(Excerpt from 40 CFR Part 136 Table I and II)

Parameter	Container(1)	Preservative(2,3)	Maximum Holding Time(4)	EPA Test Method (1979) (unless otherwise noted)
BACTERIAL TESTS				
Coliform, fecal and total	P,G	Cool, 4°C 0.008% $Na_2S_2O_3$(6)	6 hours	Standard Methods 15th Ed.:908
Fecal streptococci	P,G	Cool, 4°C 0.008% $Na_2S_2O_3$(6)	6 hours	Standard Methods 15th Ed.:910
INORGANIC TESTS				
Acidity	P,G	Cool, 4°C	14 days	305.1
Alkalinity	P,G	Cool, 4°C	14 days	310.1
Ammonia	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days	350
Biochemical oxygen demand	P,G	Cool, 4°C	48 hours	405.1
Biochemical oxygen demand, carbonaceous	P,G	Cool, 4°C	48 hours	Standard Methods 16th Ed.:507(5.e.6)
Bromide	P,G	None required	28 days	320.1
Chemical oxygen demand	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days	410
Chloride	P,G	None required	28 days	325
Chlorine, total residual	P,G	None required	Analyze immediately	330
Color	P,G	Cool, 4°C	48 hours	110

Table 5-3

Required Containers, Preservation Techniques, Holding Times, and Test Methods
(Excerpt from 40 CFR Part 136 Table I and II) (Continued)

Parameter	Container(1)	Preservative(2,3)	Maximum Holding Time(4)	EPA Test Method (1979) (unless otherwise noted)
Cyanide, total and amenable to chlorination	P,G	Cool, 4°C NaOH to pH>12 0.6 g ascorbic acid(5)	14 days(6)	335
Fluoride	P	None required	28 days	340
Hardness	P,G	HNO_3 to pH<2, H_2SO_4 to pH<2	6 months	130
Hydrogen ion (pH)	P,G	None required	Analyze immediately	150.1
Kjeldahl and organic nitrogen	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days	351
METALS(7)				
Chromium VI	P,G	Cool, 4°C	24 hours	218.4
Mercury	P,G	HNO_3 to pH<2	28 days	245
Metals except above	P,G	HNO_3 to pH<2	6 months	(Various EPA Methods)
Nitrate	P,G	Cool, 4°C	48 hours	352.1
Nitrate-nitrite	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days	353
Nitrite	P,G	Cool, 4°C	48 hours	354
Oil and grease	G	Cool, 4°C H_2SO_4 to pH<2	28 days	413
Organic carbon	P,G	Cool, 4°C HCl or H_2SO_4 to pH<2	28 days	415

Table 5-3

Required Containers, Preservation Techniques, Holding Times, and Test Methods
(Excerpt from 40 CFR Part 136 Table I and II)(Continued)

Parameter	Container(1)	Preservative(2,3)	Maximum Holding Time(4)	EPA Test Method (1979) (unless otherwise noted)
Orthophosphate phosphorus	P,G	Filter immediately Cool, 4°C	48 hours	365
Dissolved oxygen				
Probe	G bottle & top	None required	Analyze immediately	360
Winkler	G bottle & Top	Fix on-site and store in the dark	8 hours	
Phenols	G	Cool, 4°C H_2SO_4 to pH<2	24 hours	420
Phosphorus (elemental)	G	Cool, 4°C	48 hours	Note (16)
Phosphorus, total dissolved	P,G	Cool, 4°C H_2SO_4 to pH<2	28 days	365
Residue, total	P,G	Cool, 4°C	7 days	160.3
Residue, filterable	P,G	Cool, 4°C	7 days	160.1
Residue, nonfilterable (TSS)	P,G	Cool, 4°C	7 days	160.2
Residue, settleable	P,G	Cool, 4°C	48 hours	160.5
Residue, volatile	P,G	Cool, 4°C	7 days	160.4
Silica	P	Cool, 4°C	28 days	370.1
Specific conductance	P,G	Cool, 4°C	28 days	120.1
Sulfate	P,G	Cool, 4°C	28 days	375

Table 5-3

Required Containers, Preservation Techniques, Holding Times, and Test Methods
(Excerpt from 40 CFR Part 136 Table I and II)(Continued)

Parameter	Container(1)	Preservative(2,3)	Maximum Holding Time(4)	EPA Test Method (1979) (unless otherwise noted)
Sulfide	P,G	Cool, 4°C add zinc acetate plus sodium hydroxide pH >9	7 days	376
Sulfite	P,G	None required	Analyze immediately	377
Surfactants	P,G	Cool, 4°C	48 hours	425.1
Temperature	P,G	None required	Analyze immediately	170.1
Turbidity	P,G	Cool, 4°C	48 hours	180.1
ORGANIC TESTS (8)				
Purgeable halocarbons	G, teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$(5)	14 days	601 (40 CFR 136 Appendix A, 1984)
Purgeable aromatic hydrocarbons	G, teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$(5) HCl to pH 2(9)	14 days	602 (40 CFR 136 Appendix A, 1984)
Acrolein and acrylonitrile	G, teflon-lined septum	Cool, 4°C 0.008% $Na_2S_2O_3$(5) Adjust pH to 4.5(10)	14 days	603 (40 CFR 136 Appendix A, 1984)
Phenols	G, teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction	604 (40 CFR 136 Appendix A, 1984)

Table 5-3

Required Containers, Preservation Techniques, Holding Times, and Test Methods
(Excerpt from 40 CFR Part 136 Table I and II) (Continued)

Parameter	Container(1)	Preservative(2,3)	Maximum Holding Time(4)	EPA Test Method (1979) (unless otherwise noted)
Benzidenes(11)	G, teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$(5)	7 days until extraction(13)	605 (40 CFR 136 Appendix A, 1984)
Phthalate esters(11)	G, teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction	606 (40 CFR 136 Appendix A, 1984)
Nitrosamines(11,14)	G, teflon-lined cap	Cool, 4°C Store in the dark 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction	607 (40 CFR 136 Appendix A, 1984)
Polychlorinated biphenyls (PCBs)(11)	G, teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction	608 (40 CFR 136 Appendix A, 1984)
Nitroaromatics and isophorone(11)	G, teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$(5) Store in the dark	7 days until extraction; 40 days after extraction	609 (40 CFR 136 Appendix A, 1984)
Polynuclear aromatic hydrocarbons(11)	G, teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$(5) Store in the dark	7 days until extraction; 40 days after extraction	610 (40 CFR 136 Appendix A, 1984)
Haloethers(11)	G, teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction	611 (40 CFR 136 Appendix A, 1984)

Table 5-3

Required Containers, Preservation Techniques, Holding Times, and Test Methods
(Excerpt from 40 CFR Part 136 Table I and II) (Continued)

Parameter	Container(1)	Preservative(2,3)	Maximum Holding Time(4)	EPA Test Method (1979) (unless otherwise noted)
Chlorinated hydrocarbons(11)	G, teflon-lined cap	Cool, 4°C	7 days until extraction; 40 days after extraction	612 (40 CFR 136 Appendix A, 1984)
TCDD (2,3,7,8-Tetrachlorodibenzo-p-Dioxin)(11)	G, teflon-lined cap	Cool, 4°C 0.008% $Na_2S_2O_3$(5)	7 days until extraction; 40 days after extraction	613 (40 CFR 136 Appendix A, 1984)
PESTICIDES TEST				
Organochlorine pesticides(11)	G, teflon-lined cap	Cool, 4°C pH 5-9(15)	7 days until extraction; 40 days after extraction	608 (40 CFR 136 Appendix A, 1984)
RADIOLOGICAL TEST				
Alpha, beta, and radium	P,G	HNO_3 to pH<2	6 months	Method 900-903(17)

(1)Polyethylene (P) or glass (G).

(2)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 automatic sampler makes it impossible to preserve each aluqiot, then chemical samples may be preserved by maintaining at 4°C until compositing and sample splitting in completed.

(3)When any sample is to be shipped by common carrier or sent through the United States mail, 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 this Table, 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_3) in 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 0.80% by weight or less (pH about 12.30 or less).

Table 5-3

Required Containers, Preservation Techniques, Holding Times, and Test Methods
(Excerpt from 40 CFR Part 136 Table I and II) (Continued)

(4)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 the specific types of samples under study are stable for the longer time and has received a variance from the Regional Administrator under § 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 this is necessary to maintain sample stability.

(5)Should only be used in the presence of residual chlorine.

(6)Maximum holding time is 24 hours when sulfide is present. Optionally, all samples may be tested with lead acetate paper before pH adjustments 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, then NaOH is added to pH 12.

(7)Samples should be filtered immediately on-site before adding preservative for dissolved metals.

(8)Guidance applies to samples to be analyzed by GC, LC, or GC/MS for specific organic compounds.

(9)Sample receiving no pH adjustment must be analyzed within 7 days of sampling.

(10)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.

(11)When the extractable analytes of concern fall within a single chemical category, the specified preservation and maximum holding times should be observed for optimum safeguarding of sample integrity. When the analytes of concern fall within two or more chemical categories, the sample may be preserved by cooling to 4°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 7 days before extraction and for 40 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).

Table 5-3

Required Containers, Preservation Techniques, Holding Times, and Test Methods
(Excerpt from 40 CFR Part 136 Table I and II) (Continued)

(12)If 1,2-diphenylhydrazine is likely to be present, adjust the pH of the sample to 4.0 $\pm$ 0.2 to prevent rearrangement of benzidine.

(13)Extracts may be stored up to 7 days before analysis if storage is conducted under an inert (oxidant-free) atmosphere.

(14)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.

(15)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_2SO_3.

(16)K.F. Addison and R.G. Ackman, "Direct Determination of Elemental Phosphorus by Gas-Liquid Chromatography," Journal of Chromatography, 47 (3): 421-426, 1970.

(17)Reference: "Prescribed Procedures for Measurement of Radioactivity in Drinking Water" EPA-600/4-80-032 (1980 update) USEPA, August 1980.

SAMPLING RECORD

Person Sampling: _____

Date: _____ Time: _____ am/pm

Facility Sampled: _____

Facility Location: _____

_____

_____

Sampling Location: _____

_____

_____

Sample Type: Grab ( ) Composite ( )

Observation/Comments: _____

_____

_____

_____

Sample Bottle I.D. (marking) _____

Samples split with facility? Yes ( ) No ( )

Name of Facility Representing: _____

Title of Facility Representing: _____

TIME/DATE	SAMPLE RECEIVED BY	AFFILIATION/ TITLE	COMMENTS

Figure 5-1

Example Chain-of-Custody Form

C REFERENCES AND PERMITTEE SAMPLING INSPECTION CHECKLIST

References

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Wood, L.B., and Stanbridge, H.H. 1968. "Automatic Samplers," Water Pollution Control, 67(5): 495-520.

PERMITTEE SAMPLING INSPECTION CHECKLIST

A. PERMITTEE SAMPLING EVALUATION

Yes No N/A	1. Samples taken at sites specified in permit.
Yes No N/A	2. Locations adequate for representative samples.
Yes No N/A	3. Flow proportioned samples obtained when required by permit.
Yes No N/A	4. Sampling and analysis completed on parameters specified by permit.
Yes No N/A	5. Sampling and analysis done in frequency specified by permit.
Yes No N/A	6. Permittee uses method of sample collection required by permit. Required method: _____ If not, method being used is: ( ) Grab ( ) Manual composite ( ) Automatic composite
	7. Sample collection procedures adequate:
Yes No N/A	a. Samples refrigerated during compositing
Yes No N/A	b. Proper preservation techniques used
Yes No N/A	c. Containers and sample holding times before analyses conform to 40 CFR Part 136.3
Yes No N/A	d. Samples analyzed in timeframe needed (same day, etc.).
Yes No N/A	8. Monitoring and analyses performed more often than required by permit. If so, results reported in permittee's self-monitoring report.
Yes No N/A	9. Samples contain chlorine.
Yes No N/A	10. Contract laboratory used for sample analysis.
Yes No N/A	11. POTW collects samples from industrial users in pretreatment program.

B. SAMPLING INSPECTION PROCEDURES AND OBSERVATIONS

Yes No N/A	1. Grab samples obtained.
Yes No N/A	2. Composite sample obtained. Compositing frequency:_____ Preservation:_____
Yes No N/A	3. Sample refrigerated during compositing.
Yes No N/A	4. Flow proportioned sample obtained.
Yes No N/A	5. Sample obtained from facility sampling device.
Yes No N/A	6. Sample representative of volume and nature of discharge.
Yes No N/A	7. Sample split with permittee.
Yes No N/A	8. Chain-of-custody procedures employed.
Yes No N/A	9. Samples collected in accordance with permit.
Yes No N/A	10. Excessive foam, grease, floating solids observed at the outfall.

Chapter Six

FLOW MEASUREMENT

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Chapter Six

A EVALUATION OF PERMITTEE'S FLOW MEASUREMENT

Objectives and Requirements

To comply with the permit requirements established under the National Pollutant Discharge Elimination System (NPDES), the permittee must accurately determine the quantity of wastewater being discharged. Therefore, discharge flow measurement is an integral part of the NPDES program and the accuracy of the measurement must be evaluated by the inspector.

In addition to providing usable information for enforcement purposes, flow measurement serves to:

- Provide operating and performance data on the wastewater treatment plant
- Compute treatment costs, based on wastewater volume
- Obtain data for long-term planning of plant capacity, versus capacity used.

A Flow Measurement Inspection Checklist for the inspector's use appears at the end of this chapter.

Evaluation of Facility Installed Flow Devices and Data

Two types of wastewater flow can be encountered: closed channel flow and open channel flow. Closed channel flow occurs under pressure in a liquid-full conduit (usually a pipe). Flow in closed channels is usually measured by a metering device inserted into the conduit. Examples of closed channel flow measuring devices are the Venturi meter, the pitot tube, and the electromagnetic flowmeter. In practice, closed channel flow is normally encountered only between treatment units in a wastewater treatment plant, where liquids and/or sludges are pumped under pressure.

Open channel flow occurs in conduits that are not liquid-full. Partially full pipes, not under pressure, are classified as open channels. Open channel flow is the most prevalent type of flow at NPDES-regulated discharge points.

Open channel flow is measured using primary and secondary devices. Primary devices are calibrated hydraulic structures, such as flumes and weirs, that are inserted in the open channel. Accurate flow measurements can be obtained merely by measuring the depth of liquid (head) at the specific point in the primary device. In a weir application, for example, the flow rate is a function of the head of liquid above the weir crest.

Secondary devices are used in conjunction with primary devices to automate the flow measuring process. Typically, secondary devices measure the liquid depth in the primary device and convert the depth measurement to a corresponding flow, using established mathematical relationships. Examples of secondary devices are floats, ultrasonic transducers, and bubblers. The output of the secondary device generally is transmitted to a recorder and/or totalizer to provide instantaneous and historical flow data to the operator. Outputs may also be transmitted to sampling systems to facilitate flow-proportioning.

The permittee must obtain accurate wastewater flow data to calculate mass loading (quantity) from measured concentrations of pollutants discharged as required by many NPDES permits. The permittee must produce data that meet requirements in terms of precision and accuracy. Precision refers to data reproducibility or the ability to obtain consistent data from repeated measurements of the same quantity. Accuracy refers to the agreement between the amount of a component measured by the test and the amount actually present.

The accuracy of flow measurement (including both primary and secondary devices) varies widely with the device, its location, environmental conditions, and other factors such as maintenance and calibration. Faulty fabrication, construction, and installation of primary devices are common sources of errors. Improper calibration, misreading, and variation in the speed of totalizer drive motors are major errors related to secondary devices.

When evaluating facility installed devices, the inspector should:

- Verify that the primary and secondary devices have been installed according to manufacturer's instructions and other applicable plans and specifications.

- Inspect the primary device for evidence of corrosion, scale formation, or solids accumulation that may bias the flow measurement.

- Verify that weirs are level, plumb, and perpendicular to the flow direction.

- Verify that flumes are level, the throat walls are plumb, and the throat width is the standard size intended.

- Inspect historical records (strip charts, logs, etc.) for evidence of continuous flow measurements. Compare periods of missing data with maintenance logs for explanations of measuring system problems.

- Observe the flow patterns near the primary device for excessive turbulence or velocity. The flow lines should be straight.

- Ensure that the flow measurement system or technique being used measures the entire wastewater discharge as required by the NPDES permit. A careful inspection should be conducted to determine whether there are any wastewater diversions or bypasses around the system. Make sure the system meets the permit requirement, such as instantaneous or continuous, daily or other time interval. Anomalies should be reported on the inspection form.

- Verify that the site chosen for flow measurement is appropriate and is in accordance with permit requirements.

- Verify that the site chosen for flow measurement is suitable for type of discharge, flow range, suspended solids concentration, and other relevant factors.

- Verify that tables, curves, and formulas are appropriate and are used correctly to calculate flow rates.

- Review and evaluate calibration and maintenance programs for the discharger's flow measurement system. The permit normally requires that calibration be checked regularly by the permittee. The calibration of flow measurement systems must be checked often enough to ensure their accuracy. Lack of such a program is considered unacceptable for NPDES compliance purposes.

- Verify that primary and secondary devices are adequate for normal flow as well as maximum expected flow. Note whether the flow measurement system can measure the expected range of flow.

- Collect accurate flow data during inspection to validate self-monitoring data collected by the permittee.

Evaluation of Permittee Data Handling and Reporting

The permittee or facility must keep flow measurement records for a minimum period of three years as the permit requires. Many flow measuring devices produce a continuous flow chart for plant records. Flow records should contain date, flow, time of reading, and operator's name, if applicable. Maintenance, inspection dates, and calibration data should also be recorded.

The inspector should review the permittee's records and note the presence or absence of data such as:

- Frequency of routine operational inspections
- Frequency of maintenance inspections
- Frequency of flowmeter calibration
- Irregularity or uniformity of flow.

Evaluation of Permittee Quality Control

The following quality control issues should be evaluated carefully during a compliance inspection:

- Proper operation and maintenance of equipment
- Accurate records
- Sufficient inventory of spare parts
- Valid flow measurement techniques
- Precise flow data
- Adequate frequency of calibration checks.

Precision can be evaluated at float driven devices when flows are stable. The float is pushed gently downward, held for 30 seconds, then allowed to return normally. The recorded flow rate should be the same before and after the float was moved. Accuracy can be evaluated by measuring the instantaneous flow rate at the primary device used at the facility and comparing the value against the value on the meter, graph, integrator, or company record. The difference between two stable totalizer readings (flow is steady for 10 minutes or more) should not exceed ± 10 percent of the instantaneous flow measured at the primary device.

Accuracy can also be evaluated by installing a second flow measurement system, sometimes referred to as a reference system. Agreement in measured flow rates between the two systems should be within ± 10 percent of the reference rate if all conditions are as recommended for the systems.

B SUPPLEMENTARY INFORMATION

Basic Hydraulic Calculations

The relationship between the flow rate (Q), the average velocity (V) and the cross-sectional area of the flow (A) is given by the following equation:

$$Q = VA$$

Q is flow in cubic feet per second
V is velocity in feet per second
A is area in square feet

To convert flow in cubic feet of water per second to flow in gallons of water per minute, the following proportionality is used:

$$\frac{\text{cubic feet}}{\text{second}} \times \frac{\text{7.48 gallons water}}{\text{cubic foot of water}} \times \frac{\text{60 seconds}}{\text{minute}} = \frac{\text{gallons}}{\text{minute}}$$

To convert from cubic feet per second to million gallons per day, multiply the number of cubic feet per second by 0.6463.

The cross-sectional area (A) of a pipe is described by:

$A = 1/4\ \pi\ d^2$, where d is the diameter of the pipe in feet

Flow Measurement Devices

Flow data may be collected instantaneously or continuously. Instantaneous flows must be measured when samples are taken so that the pollutant concentrations can be correlated to flow data. In a continuous flow measurement system, flow measurements are summed to obtain a value for the total flow to verify NPDES permit compliance.

A typical continuous flow measurement system consists of a flow device, a flow sensor, transmitting equipment, a recorder, and a totalizer.

Instantaneous flow data can be obtained without using such a system. The primary flow device is constructed to yield predictable hydraulic responses related to the rate of wastewater or water flowing through the device. As previously mentioned, examples of such devices include weirs and flumes, which relate water depth (head) to flow; Venturi meters, which relate differential pressure to flow; and electromagnetic flow meters, which relate induced electric voltage to flow. In most cases, a standard primary flow device has undergone detailed testing and experimentation and its accuracy has been verified.

Flow is measured by many methods; some are designed to measure open channel flows, others are designed to measure flows in pipelines. A complete discussion of all available flow measurement methods, their supporting theories, and the devices used are beyond the scope of this manual. The most commonly used flow measurement devices and procedures for inspecting them will be described briefly in the following paragraphs. For more detail, inspectors should consult the publications listed in "References" at the end of this chapter.

Primary Devices

Weirs. A weir consists of a thin vertical plate with a sharp crest that is placed in a stream, channel, or partly filled pipe. Figure 6-1 shows a profile of a sharp-crested weir and indicates the appropriate nomenclature. Four common types of sharp-crested weirs are shown in Figure 6-2. This figure illustrates the difference between supressed and contracted rectangular weirs as well as illustrates Cipolletti (trapezoidal) and V-notch (triangular) weirs.

To determine the flow rate, it is necessary to measure the hydraulic head (height) of water above the crest of the weir. For accurate flow measurements, the crest must be clean, sharp, and level. The edge of the crest must not be thicker than 1/8 inch.

The rate of flow over a weir is directly related to the height of the water (head) above the crest at a point upstream of the weir where the water surface is level. To calculate the discharge over a weir, the head must first be measured by placing a measuring device upstream of the weir, at a distance of at least 4 times an approximate measurement of the head. A measurement can be taken at the weir plate to approximate the head. However, if this measurement is used to calculate the discharge, this value will provide only a rough estimate of the discharge.

The head-discharge relationship formulas for nonsubmerged contracted and suppressed rectangular weirs, Cipolletti weirs, and V-notch weirs are provided in Table 6-1. Discharge rates for the 90-degree V-notch weir (when the head is measured at the weir plate) are included in Table 6-2. Flow rates for 60- and 90-degree V-notch weirs can be determined from the nomograph in Figure 6-3. Minimum and maximum recommended flow rates for Cipolletti weirs are provided in Table 6-3. Figure 6-4 is a nomograph for flow rates for rectangular weirs using the Francis formulas.

Parshall Flume. The Parshall flume is composed of three sections: a converging upstream section, a throat or contracted section, and a diverging or dropping downstream section. When there is free fall out of the throat of a Parshall flume, no diverging downstream section is required. It operates on the principle that when open channel water flows through a constriction in the channel, it produces a hydraulic head at a certain point upstream of the constriction that is proportional to the flow. The hydraulic head is used to calculate the flow. Flow curves are shown in Figure 6-5 to determine free flow through 3 inches to 50 feet Parshall flumes.

The Parshall flume is good for measuring open channel waste flow because it is self cleaning; therefore, sand or suspended solids are unlikely to effect the operation of the device. The flume is both simple and accurate.

The flume size is given by the width of the throat section. Parshall flumes have been developed with throat widths from 1 inch to 50 feet. The configuration and standard nomenclature for Parshall flumes is provided in Figure 6-6. Strict adherence to all dimensions is necessary to achieve accurate flow measurements. Figure 6-6 provides Parshall flume dimensions for various throat widths and Table 6-4, provides the minimum and maximum flow rates for free flow through Parshall flumes.

For free nonsubmerged flow in a Parshall flume of throat and upstream head (H_a in feet), the discharge relationship for flumes of 8 feet or less is given by the general equation $Q = CWH_a^n$, where Q = flow.

Table 6-5 provides the values of C, n, and Q for different sizes (widths) of the Parshall flumes. Nomographs, curves, or tables are readily available to determine the discharge from head observations.

Flow through a Parshall flume may also be submerged. The degree of submergence is indicated by the ratio of the downstream head to the upstream head (H_b/H_a) which is the submergence ratio. H_b is the height of water measured above the crest. The flow is submerged if the submerged ratio is:

- Greater than 0.5 for flumes under 3 inches
- Greater than 0.6 for flumes 6 to 9 inches
- Greater than 0.7 for flumes 1 to 8 feet
- Greater than 0.8 for flumes larger than 8 feet.

If submerged conditions exist, the inspector should apply a correction factor to the free flow determined using the relationship $Q= CWH^n$. These correction factors are shown in Figure 6-7 for different sizes of the Parshall flume.

Palmer-Bowlus Flume. The Palmer-Bowlus flume is also composed of three sections: a converging upstream section, a contracted section or throat, and a diverging downstream section (Figure 6-8). The upstream depth of the water (head) above the raised step in the throat is related to the discharge rate. The head should be measured a distance d/2 upstream of the throat where d is the size (width) of the flume. The height of the step is ususally unknown until the manufacturer's data is consulted, it is difficult to manually measure the height of water above the step at an upstream point. The dimensions for Palmer-Bowlus flumes are not standardized

as they are for Parshall flumes. Therefore, no standard flow equation exists. Instead, rating curves are provided by manufacturers of Palmer-Bowlus flumes to relate the head to the discharge rate.

The flume must be installed with a minimum channel slope downstream to maintain critical flow through the flume and prevent the flume from becoming submerged. A small jump or rise in the water surface below the throat indicates that critical flow through the flume has probably occurred and submerged conditions exist. Accurate flow measurements can usually be obtained with upstream depths that are up to 95 percent of the pipe diameter. Table 6-6 provides a table of the maximum slopes recommended for installation of Palmer-Bowlus flumes.

Advantages of this type of flow measurement device are:

- It is easily installed in existing systems
- Head loss is insignificant
- Unit is self cleaning.

Venturi Meter. The Venturi (differential pressure) meter is one of the most accurate primary devices for measuring flow rates in pipes. The Venturi meter is basically a pipe segment consisting of an inlet section, a converging section, a throat, and with a diverging outlet section as illustrated in Figure 6-9. The water velocity is increased in the constricted portion of the inlet section resulting in a decrease in the static pressure. The pressure difference between the inlet pipe and the throat is proportional to the square of the flow. The pressure difference can easily be measured very accurately, resulting in an accurate flow measurement. One of the advantages of the Venturi meter is that it causes little pressure (head) loss.

The formula for calculating the flow in a Venturi meter is as follows:

$$Q = cKd_2^2\sqrt{h_1 - h_2} \qquad \text{(King 1963)}$$

where:

Q = volume of water, in cubic feet per second

c = discharge coefficient, obtain from Table 6-7. C varies with Reynold's number, meter surfaces, and installation

h_1 = pressure head at center of pipe at inlet section, in feet of water

h_2 = pressure head at throat, in feet of water

K = constant which relates d_2 to d_1 for Venturi meters. Obtain values of K from Table 6-8 or calculate according to the formula

$$K = \frac{}{4} \sqrt{\frac{2g}{1-\left[\frac{d_2}{d_1}\right]^4}} \qquad \text{(King, 1963)}$$

where:

d_2 = throat diameter, in feet

d_1 = diameter of inlet pipe, in feet

Electromagnetic Flowmeter. The electromagnetic flowmeter operates according to Faraday's Law of Induction: the voltage induced by a conductor moving at right angles through a magnetic field will be proportional to the velocity of the conductor through the field. In the electromagnetic flowmeter, the conductor is the liquid stream to be measured and the field is produced by a set of electromagnetic coils. A typical electromagnetic flowmeter is shown in Figure 6-10. The induced voltage is transmitted to a converter for signal conditioning. The meter may be provided with recorder and totalizer using electric or pneumatic transmission systems. This type of flowmeter is useful at sewage lift stations and for measuring total raw wastewater flow or raw or recirculated sludge flow.

Electromagnetic flowmeters are used in full pipes and have many advantages, including: accuracies of ± 1 percent, a wide flow measurement range, a negligible pressure loss, no moving parts, and rapid response time. However, they are expensive and buildup of grease deposits or pitting by abrasive wastewaters can cause error. Regular checking and cleaning of the electrodes is necessary. The meter electronics can be checked for proper operation with devices especially made for this purpose. The meter should be checked at least annually. The calibration of an electromagnetic flow meter can not be verified except by returning it to the factory or by the dye dilution method.

Propeller Meter. The propeller meter (Figure 6-11) operates on the principle that liquid hitting the propeller will cause the propeller to rotate at a speed proportional to the flow rate. The meter is self-contained and requires no energy or equipment other than a mechanical totalizer to obtain a cumulative flow reading. Equipment may be added to the meter to produce a flow reading, to pace chemical feed equipment, and to control telemetering equipment for remote readout. The calibration of a propeller meter can be checked by returning it to the factory, by comparing its readings to another meter measuring the same flow, or by using the dye dilution method.

Secondary Devices

Secondary devices are the devices in the flow measurement system that translate the interaction of primary devices in contact with the fluid into the desired records or readout. They can be organized into two broad classes:

- Nonrecording type with direct readout (e.g., a staff gauge) or indirect readout from fixed points (e.g., a chain, wire weight, float)

- Recording type with either digital or graphic recorders (e.g., float in well, float in flow, bubbler, electrical, acoustic).

The advantages and disadvantages of various secondary devices are provided in Table 6-9.

Pumps

Some wastewater facilities may need to measure flow by means of pumps in which discharge-versus-power relationships have been determined from measurements of the average output or input during a period in which discharge measurements were made. Suitable curves may be developed from these test data. When readily available from the manufacturer, pump curves may be used by the inspector to estimate flow.

Due to wear on pumps and uncertainty regarding actual discharge heads, pump curves at best only provide an estimate of the flow. Pump curves are not normally accurate enough to be used for NPDES permit discharge flow measurements. Pump curves have been used for determining large flows, such as the cooling water discharge from large steam electric power plants, where a high degree of accuracy was not necessary.

Table 6-1

Head-Discharge Relationship Formulas for Nonsubmerged Weirs*

Weir Type	Contracted	Suppressed	Remarks	Reference
Rectangular				
Francis formulas	$Q = 3.33\ (L - 0.1nH)H^{1.5}$	$Q = 3.33\ L\ H^{1.5}$	Approach velocity neglected	King 1963
	$Q = 3.33\ [(H + h)^{1.5} - h^{1.5}](L - 0.1nH)$	$Q = 3.33\ L[(H + h)^{1.5} - h^{1.5}]$	Approach velocity considered	King 1963
Cipolletti	$Q = 3.367\ L\ H^{1.5}$	NA	Approach velocity neglected	King 1963
	$Q = 3.367\ L\ (H + h)^{1.5} - h^{1.5}$	NA	Approach velocity considered	EPA 1973
V-notch				
Formula for 90° V-notch only	$Q = 2.50\ H^{2.5}$	NA	Not appreciably affected by approach velocity	King 1963
	$Q = 3.01\ H_w^{2.48}$	NA	Head measured at weir plate	Eli and Peterson 1979 EPA-61809A-2B

Q = discharge in cubic feet per second
H = head in feet
NA = not applicable
H_w = head in feet at weir plate
n = number of end contractions

L = crest length in feet
h = head in feet due to the approach velocity = $V^2/2g$
V = approach velocity
g = gravity (32.2 ft/sec^2)

*Selection of a formula depends on its suitability and parameters under consideration.

TABLE 6-2 DISCHARGE OF 90° V-NOTCH WEIR - HEAD MEASURED AT WEIR PLATE

Head@ Weir in Feet	FLOW RATE in CFS	HEAD@ WEIR in FEET	FLOW RATE in CFS	HEAD@ WEIR in FEET	FLOW RATE in CFS
0.06	0.003	0.46	0.439	0.86	2.071
0.07	0.004	0.47	0.463	0.87	2.140
0.08	0.006	0.48	0.488	0.88	2.192
0.09	0.008	0.49	0.513	0.89	2.255
0.10	0.010	0.50	0.540	0.90	2.318
0.11	0.013	0.51	0.567	0.91	2.382
0.12	0.016	0.52	0.595	0.92	2.448
0.13	0.019	0.53	0.623	0.93	2.514
0.14	0.023	0.55	0.653	0.94	2.582
0.15	0.027	0.55	0.683	0.95	2.650
0.16	0.032	0.56	0.715	0.96	2.720
0.17	0.037	0.57	0.747	0.97	2.791
0.18	0.043	0.58	0.780	0.98	2.863
0.19	0.049	0.59	0.813	0.00	2.936
0.20	0.056	0.60	0.848	1.00	3.010
0.21	0.063	0.61	0.883	1.01	3.085
0.22	0.070	0.62	0.920	1.02	3.162
0.23	0.079	0.63	0.957	1.03	3.239
0.24	0.087	0.64	0.995	1.04	3.317
0.25	0.097	0.65	1.034	1.05	3.397
0.26	0.107	0.66	1.074	1.06	3.478
0.27	0.117	0.67	1.115	1.07	3.556
0.28	0.128	0.68	1.157	1.08	3.643
0.29	0.140	0.69	1.199	1.09	3.727
0.30	0.152	0.70	1.243	1.10	3.813
0.31	0.165	0.71	1.287	1.11	3.889
0.32	0.178	0.72	1.333	1.12	3.987
0.33	0.193	0.73	1.379	1.13	4.076
0.34	0.207	0.74	1.426	1.14	4.166
0.35	0.223	0.75	1.475	1.15	4.257
0.36	0.239	0.76	1.524	1.16	4.349
0.37	0.256	0.77	1.574	1.17	4.443
0.38	0.273	0.78	1.625	1.18	4.538
0.39	0.291	0.79	1.678	1.19	4.634
0.40	0.310	0.80	1.730	1.20	4.731
0.41	0.330	0.81	1.785	1.21	4.829
0.42	0.350	0.82	1.840	1.22	4.929
0.43	0.371	0.83	1.896	1.23	5.030
0.44	0.393	0.84	1.953	1.24	5.132
0.45	0.415	0.85	2.012	1.25	5.235

EQUATION $Q = 3.01\ Hw^{2.48}$ where Hw is head is in feet at the weir and Q is in cubic feet per second

Table 6-3

Minimum and Maximum Recommended Flow Rates
for Cipolletti Weirs

Crest Length, ft.	Minimum Head, ft.	Minimum Flow Rate		Maximum Head, ft.	Maximum Flow Rate	
		MGD	CFS		MGD	CFS
1	0.2	0.195	0.301	0.5	0.769	1.19
1.5	0.2	0.292	0.452	0.75	2.12	3.28
2	0.2	0.389	0.602	1.0	4.35	6.73
2.5	0.2	0.487	0.753	1.25	7.60	11.8
3	0.2	0.584	0.903	1.5	12.0	18.6
4	0.2	0.778	1.20	2.0	24.6	38.1
5	0.2	0.973	1.51	2.5	43.0	66.5
6	0.2	1.17	1.81	3.0	67.8	105.0
8	0.2	1.56	2.41	4.0	139.0	214.0
10	0.2	1.95	3.01	5.0	243.0	375.0

Table 6-4

Minimum and Maximum Recommended Flow Rates
for Free Flow Through Parshall Flumes

Throat Width, W	Minimum Head, Ha ft.	Minimum Flow Rate		Maximum Head, Ha ft.	Maximum Flow Rate	
		MGD	CFS		MGD	CFS
1 in.	0.07	0.003	0.005	0.60	0.099	0.153
2 in.	0.07	0.007	0.011	0.60	0.198	0.306
3 in.	0.10	0.018	0.028	1.5	1.20	1.86
6 in.	0.10	0.035	0.054	1.5	2.53	3.91
9 in.	0.10	0.059	0.091	2.0	5.73	8.87
1 ft.	0.10	0.078	0.120	2.5	10.4	16.1
1-1/2 ft.	0.10	0.112	0.174	2.5	15.9	24.6
2 ft.	0.15	0.273	0.423	2.5	21.4	33.1
3 ft.	0.15	0.397	0.615	2.5	32.6	50.4
4 ft.	0.20	0.816	1.26	2.5	43.9	67.9
5 ft.	0.20	1.00	1.55	2.5	55.3	85.6
6 ft.	0.25	1.70	2.63	2.5	66.9	103
8 ft.	0.25	2.23	3.45	2.5	90.1	139
10 ft.	0.30	3.71	5.74	3.5	189	292
12 ft.	0.33	5.13	7.93	4.5	335	519

Table 6-5

Free-Flow Values of C and N for Parshall Flume
Based on the Relationship $Q = CWH_a^n$
(American Petroleum Institute 1969)

Flume Throat, W	C	n	Max. Q cfs
1 in	0.338	1.55	0.15
2 in	0.676	1.55	0.30
3 in	0.992	1.55	1.8
6 in	2.06	1.58	3.9
9 in	3.07	1.53	8.9
1 ft	4 W *	$1.522W^{0.026}$	16.1
1.5 ft	"	"	24.6
2 ft	"	"	33.1
3 ft	"	"	50.4
4 ft	"	"	67.9
5 ft	"	"	85.6
6 ft	"	"	103.5
7 ft	"	"	121.4
8 ft	"	"	139.5

Where:

W = Flume throat width

Q = Flow (cfs)

C = Constant

H = Head upsteam of the flume throat (feet)

n = Constant

* = W should be represented in feet to calculate C

Table 6-6

Minimum and Maximum Recommended Flow Rates for Free Flow Through Plasti-Fab Palmer-Bowlus Flumes

D Flume Size, (in.)	Maximum Slope for Upstream, Percent	Minimum Head (ft.)	Minimum Flow Rate		Maximum Head (ft.)	Maximum Flow Rate	
			MGD	CFS		MGD	CFS
6	2.2	0.11	0.023	0.035	0.36	0.203	0.315
8	2.0	0.15	0.048	0.074	0.49	0.433	0.670
10	1.8	0.18	0.079	0.122	0.61	0.752	1.16
12	1.6	0.22	0.128	0.198	0.73	1.18	1.83
15	1.5	0.27	0.216	0.334	0.91	2.06	3.18
18	1.4	0.33	0.355	0.549	1.09	3.24	5.01
21	1.4	0.38	0.504	0.780	1.28	4.81	7.44
24	1.3	0.44	0.721	1.12	1.46	6.70	10.4
27	1.3	0.49	0.945	1.46	1.64	8.95	13.8
30	1.3	0.55	1.26	1.95	1.82	11.6	18.0

Table 6-7

Coefficients of Discharge c for Venturi Meters
(King 1963)

Diameter of Throat, in.	Throat Velocity, ft. per sec								
	3	4	5	10	15	20	30	40	50
1	0.935	0.945	0.949	0.958	0.963	0.966	0.969	0.970	0.972
2	0.939	0.948	0.953	0.965	0.970	0.973	0.974	0.975	0.977
4	0.943	0.952	0.957	0.970	0.975	0.977	0.978	0.979	0.980
8	0.948	0.957	0.962	0.974	0.978	0.980	0.981	0.982	0.983
12	0.955	0.962	0.967	0.978	0.981	0.982	0.983	0.984	0.985
18	0.963	0.969	0.973	0.981	0.983	0.984	0.985	0.986	0.986
48	0.970	0.977	0.980	0.984	0.985	0.986	0.987	0.988	0.988

Table 6-8

Values of K in Formula for Venturi Meters
(King 1963)

$\frac{d^2}{d^1}$	K	$\frac{d^2}{d^1}$	K	$\frac{d^2}{d^1}$	K	$\frac{d^2}{d^1}$	K	$\frac{d^2}{d^1}$	K
0.20	6.31	0.33	6.34	0.46	6.45	0.59	6.72	0.72	7.37
0.21	6.31	0.34	6.34	0.47	6.46	0.60	6.75	0.73	7.45
0.22	6.31	0.35	6.35	0.48	6.47	0.61	6.79	0.74	7.53
0.23	6.31	0.36	6.35	0.49	6.49	0.62	6.82	0.75	7.62
0.24	6.31	0.37	6.36	0.50	6.51	0.63	6.86	0.76	7.72
0.25	6.31	0.38	6.37	0.51	6.52	0.64	6.91	0.77	7.82
0.26	6.31	0.39	6.37	0.52	6.54	0.65	6.95	0.78	7.94
0.27	6.32	0.40	6.38	0.53	6.54	0.66	7.00	0.79	8.06
0.28	6.32	0.41	6.39	0.54	6.59	0.67	7.05	0.80	8.20
0.29	6.32	0.42	6.40	0.55	6.61	0.68	7.11	0.81	8.35
0.30	6.33	0.43	6.41	0.56	6.64	0.69	7.17	0.82	8.51
0.31	6.33	0.44	6.42	0.57	6.66	0.70	7.23	0.83	8.69
0.32	6.33	0.45	6.43	0.58	6.69	0.71	7.30	0.84	8.89

Table 6-9

Advantages and Disadvantages of Secondary Devices

Device	Advantages	Disadvantages
Hook gauge	Common	Require training to use, easily damaged
Stage board	Common	Needs regular cleaning, difficult to read top of meniscus
Pressure measurement		
a. Pressure bulb	Since no compressed air is used, source can be linked directly to sampler	Openings can clog, expensive
b. Bubbler tube	Self-cleaning, less expensive, reliable	Needs compressed air or other air source
Float	Inexpensive, reliable	Catches debris, requires frequent cleaning to prevent sticking and changing bouyancy, and corroding hinges
Dipper	Quite reliable, easy to operate	Oil and grease foul probe causing possible sensor loss
Ultrasonic	No electrical or mechanical contact	Errors from heavy turbulence and foam, calibration procedure is more involved than for other devices

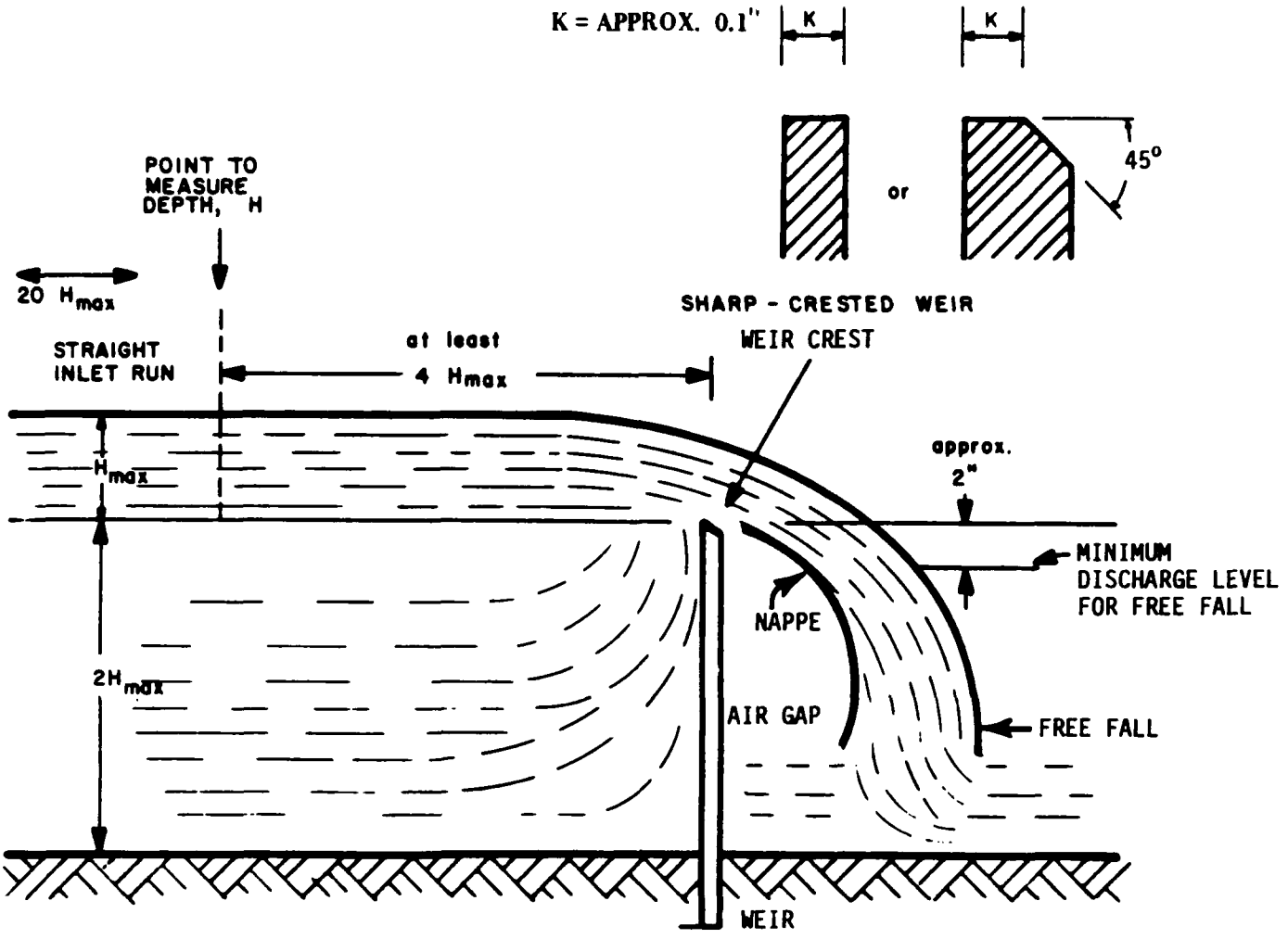
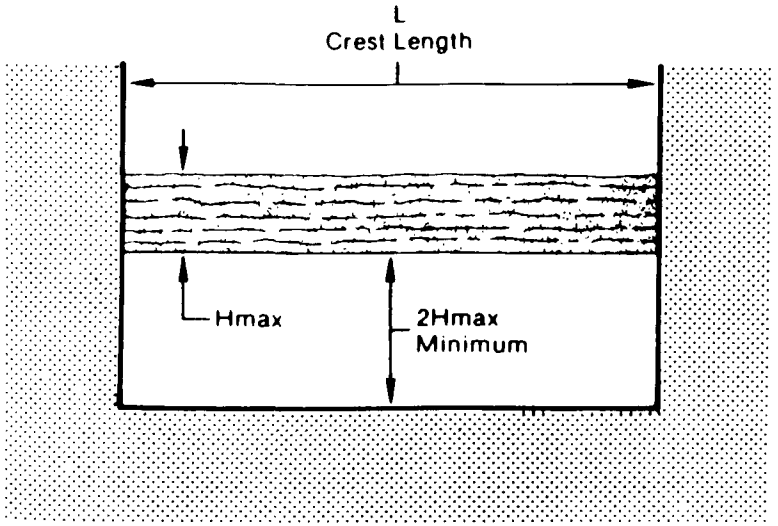
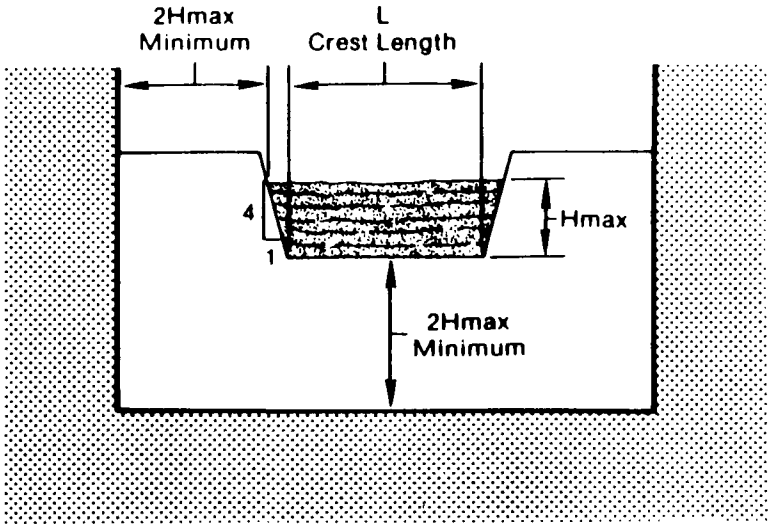


Figure 6-1

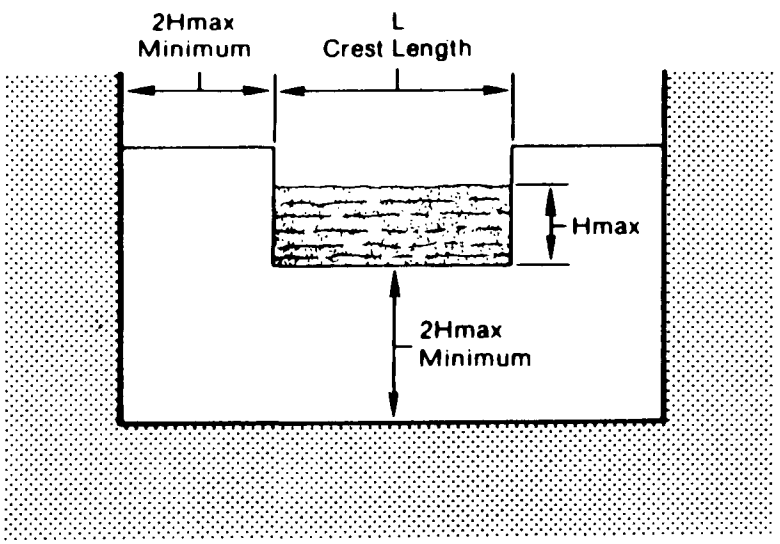
Profile and Nomenclature of Sharp-Crested Weirs
(Associated Water and Air Resource Engineers, Inc., 1973)



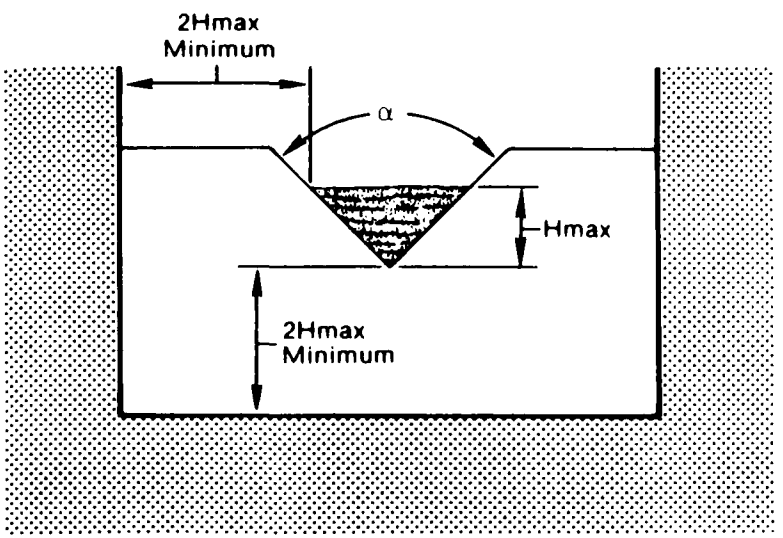
Suppressed (Without End Contractions) Rectangular Weir



Trapezoidal (Cipolletti) Sharp-Crested Weir



Contracted (With End Contractions) Rectangular Weir



V-Notch (Triangular) Sharp-Crested Weir

Figure 6-2

Three Common Types of Sharp-Crested Weirs
(Associated Water and Air Resource Engineers, Inc., 1973)

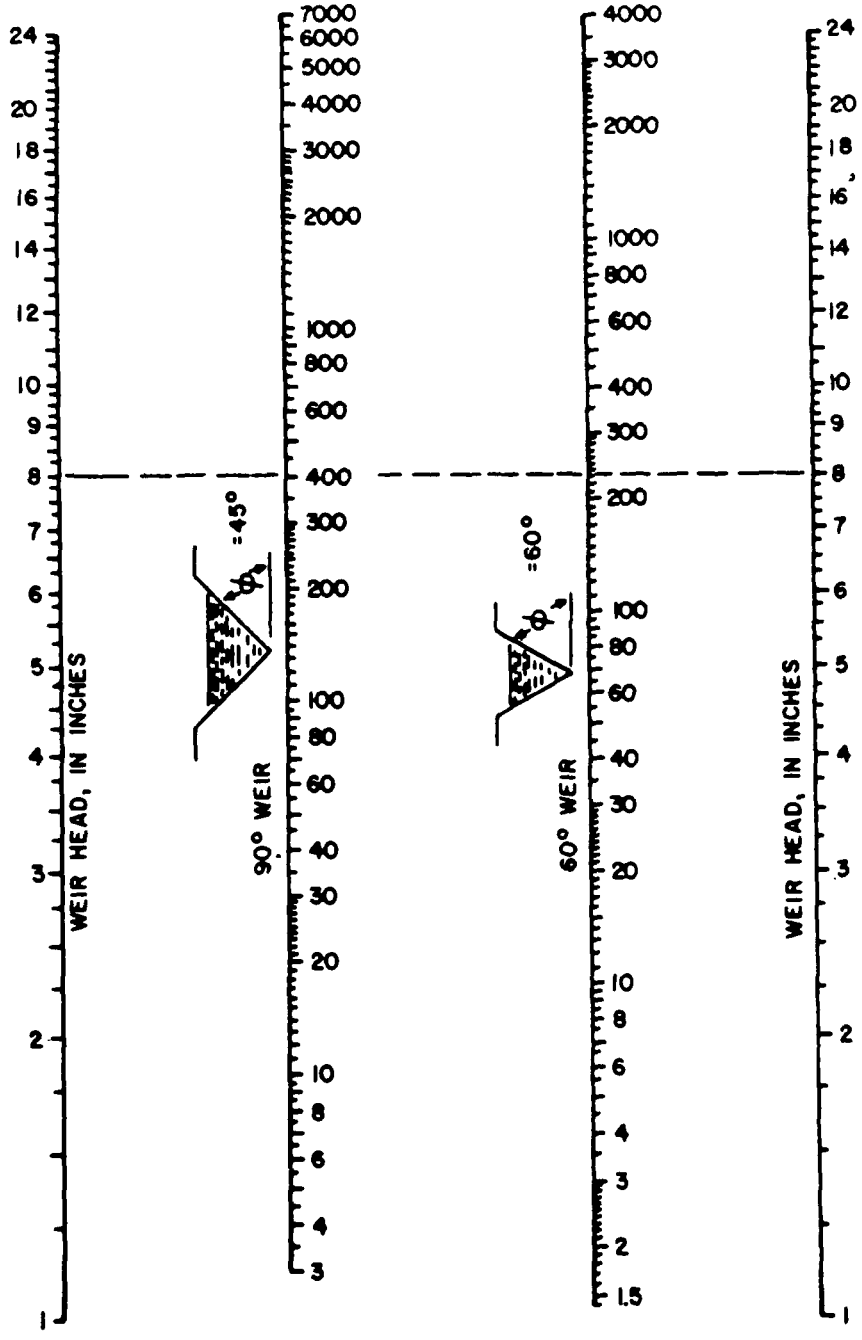
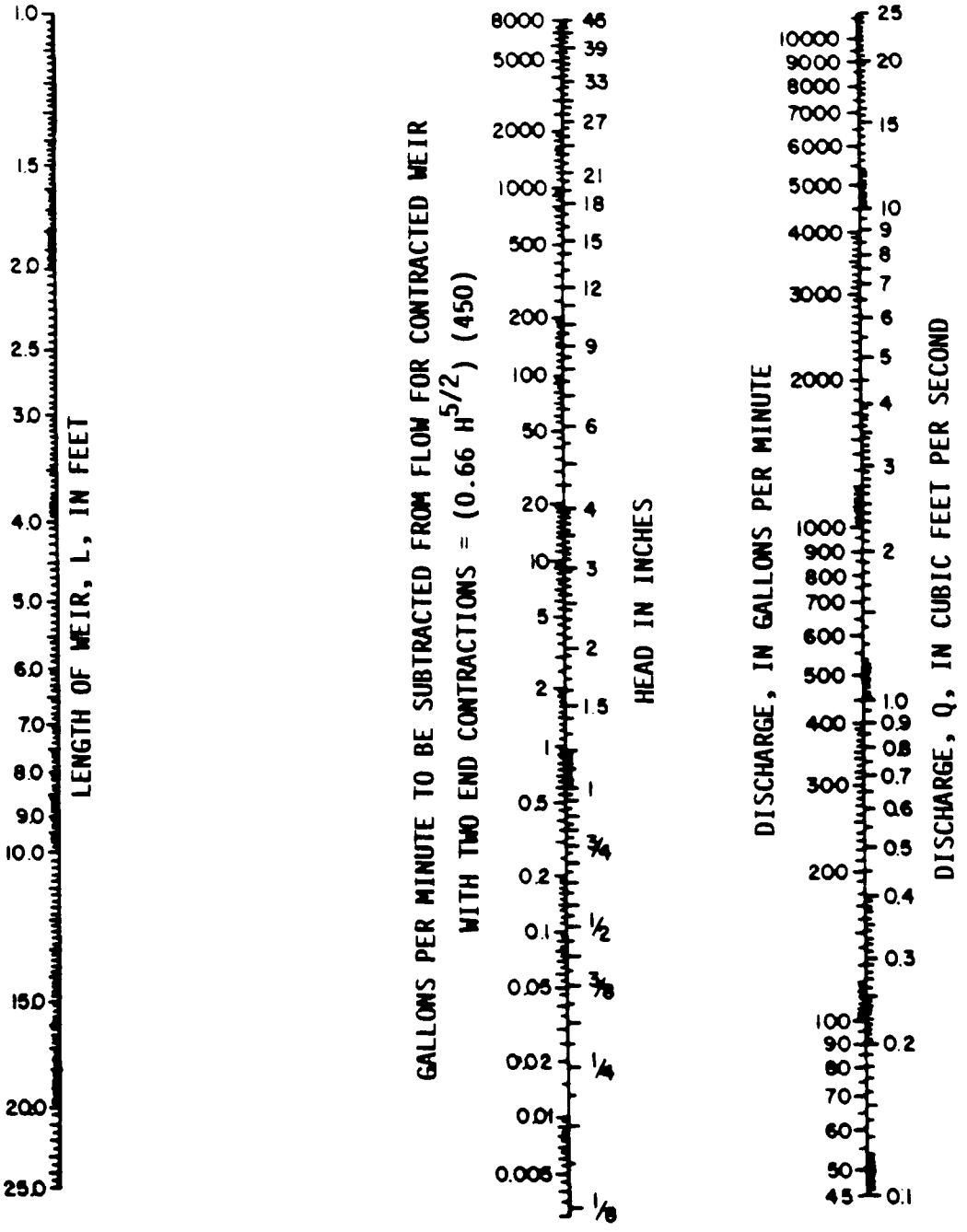


Figure 6-3

Flow Rates for 60° and 90° V-Notch Weirs
(Associated Water and Resource Engineers, Inc., 1973)



Note: Based on Francis weir formulas as follows:

$Q = 3.33\ LH^{3/2}$ (for suppressed weir)

or $Q = 3.33\ (L-0.2H)H^{3/2} - 0.66H^{5/2}$ (for contracted weir with two end contractions)

Where:
Q = discharge, in cubic feet per second
L = length of weir, in feet
H = head, in feet

Figure 6-4

Nomograph for Capacity of Rectangular Weirs
(Associated Water and Air Resource Engineers, Inc. 1973)

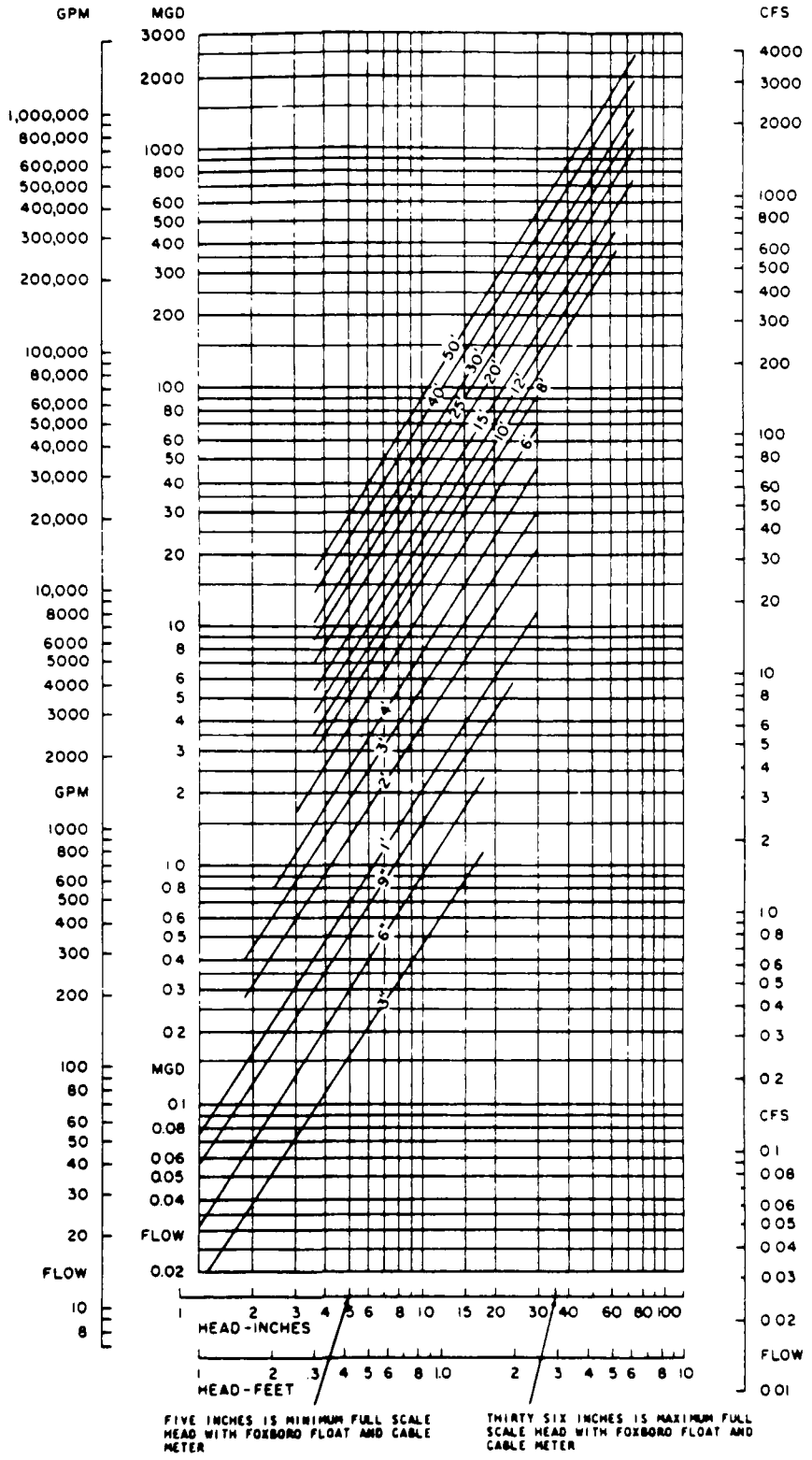


Figure 6-5

Flow Curves for Parshall Flumes
(Associated Water and Air Resource Engineers, Inc. 1973)

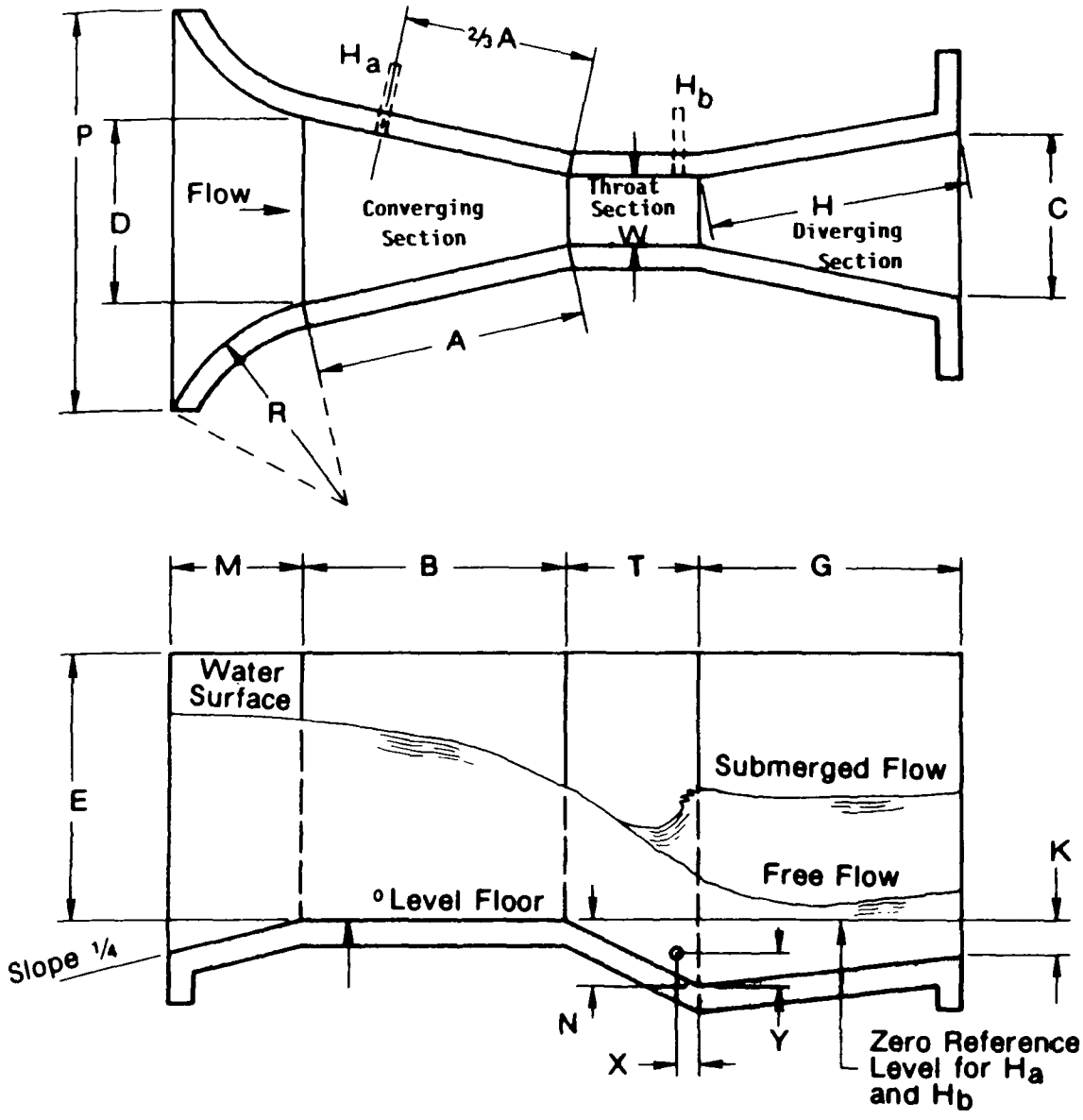


Figure 6-6

Dimensions and Capacities of Parshall Measuring Flumes for Various Throat Widths
(Associated Water and Air Resource Engineers, Inc. 1973)

W		A		$\frac{2}{3}$A		B		C		D		E		T		G		H		K	M		N	P		R		X	Y	Free-Flow Capacity (Second-Foot*)	
Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	Ft.	In.	In.	In.	Ft.	In.	Ft.	In.	Ft.	In.	In.	In.	Mini-mum	Maxi-mum
0	3	1	$6\frac{3}{8}$	1	$\frac{1}{4}$	1	6	0	7	0	$10\frac{3}{16}$	$1-1\frac{1}{2}$	0	0	6	1	0	1	$\frac{5}{32}$	1	0	0	$2\frac{1}{4}$	0	0	0	0	1	$1\frac{1}{2}$	0.03	1.9
0	6	2	$\frac{7}{16}$	1	$4\frac{5}{16}$	2	0	1	$3\frac{1}{2}$	1	$3\frac{5}{8}$	2	0	1	0	2	0	0	0	3	1	0	$4\frac{1}{2}$	2	$11\frac{1}{2}$	1	4	2	3	0.05	3.9
0	9	2	$10\frac{5}{8}$	1	$11\frac{1}{8}$	2	10	1	3	1	$10\frac{5}{8}$	2	6	1	0	1	6	0	0	3	1	0	$4\frac{1}{2}$	3	$6\frac{1}{2}$	1	4	2	3	0.09	8.9
1	0	4	6	3	0	4	$4\frac{7}{8}$	2	0	2	$9\frac{1}{4}$	3	0	2	0	3	0	0	0	3	1	3	9	4	$10\frac{3}{4}$	1	8	2	3	0.11	16.1
1	6	4	9	3	2	4	$7\frac{7}{8}$	2	6	3	$4\frac{3}{8}$	3	0	2	0	3	0	0	0	3	1	3	9	5	6	1	8	2	3	0.15	24.6
2	0	5	0	3	4	4	$10\frac{7}{8}$	3	0	3	$11\frac{1}{2}$	3	0	2	0	3	0	0	0	3	1	3	9	6	1	1	8	2	3	0.42	33.1
3	0	5	6	3	8	5	$4\frac{3}{4}$	4	0	5	$1\frac{7}{8}$	3	0	2	0	3	0	0	0	3	1	3	9	7	$3\frac{1}{2}$	1	8	2	3	0.61	50.4
4	0	6	0	4	0	5	$10\frac{5}{8}$	5	0	6	$4\frac{1}{4}$	3	0	2	0	3	0	0	0	3	1	6	9	8	$10\frac{3}{4}$	2	0	2	3	1.3	67.9
5	0	6	6	4	4	6	$4\frac{1}{2}$	6	0	7	$6\frac{5}{8}$	3	0	2	0	3	0	0	0	3	1	6	9	10	$1\frac{1}{4}$	2	0	2	3	1.6	85.6
6	0	7	0	4	8	6	$10\frac{3}{8}$	7	0	8	9	3	0	2	0	3	0	0	0	3	1	6	9	11	$3\frac{1}{2}$	2	0	2	3	2.6	103.5
7	0	7	6	5	0	7	$4\frac{1}{4}$	8	0	9	$11\frac{3}{8}$	3	0	2	0	3	0	0	0	3	1	6	9	12	6	2	0	2	3	3.0	121.4
8	0	8	0	5	4	7	$10\frac{1}{8}$	9	0	11	$1\frac{3}{4}$	3	0	2	0	3	0	0	0	3	1	6	9	13	$8\frac{1}{4}$	2	0	2	3	3.5	139.5

*Equals 1 cu. ft. per sec.

LEGEND:

W Width of flume throat.

A Length of side wall of converging section.

$\frac{2}{3}$A Distance back from end of crest to gage point.

B Axial length of converging section.

C Width of downstream end of flume.

D Width of upstream end of flume.

E Depth of flume.

T Length of flume throat.

G Axial length of diverging section.

H Length of side wall of the diverging section.

K Difference in elevation between lower end of flume and crest.

M Length of approach floor.

N Depth of depression in throat below crest.

P Width between ends of curved wing walls.

R Radius of curved wing wall.

X Horizontal distance to H_b gage point from low point in throat.

Y Vertical distance to H_b gage point from low point in throat.

Figure 6-6

Dimensions and Capacities of Parshall Measuring Flumes for Various Throat Widths (Continued)

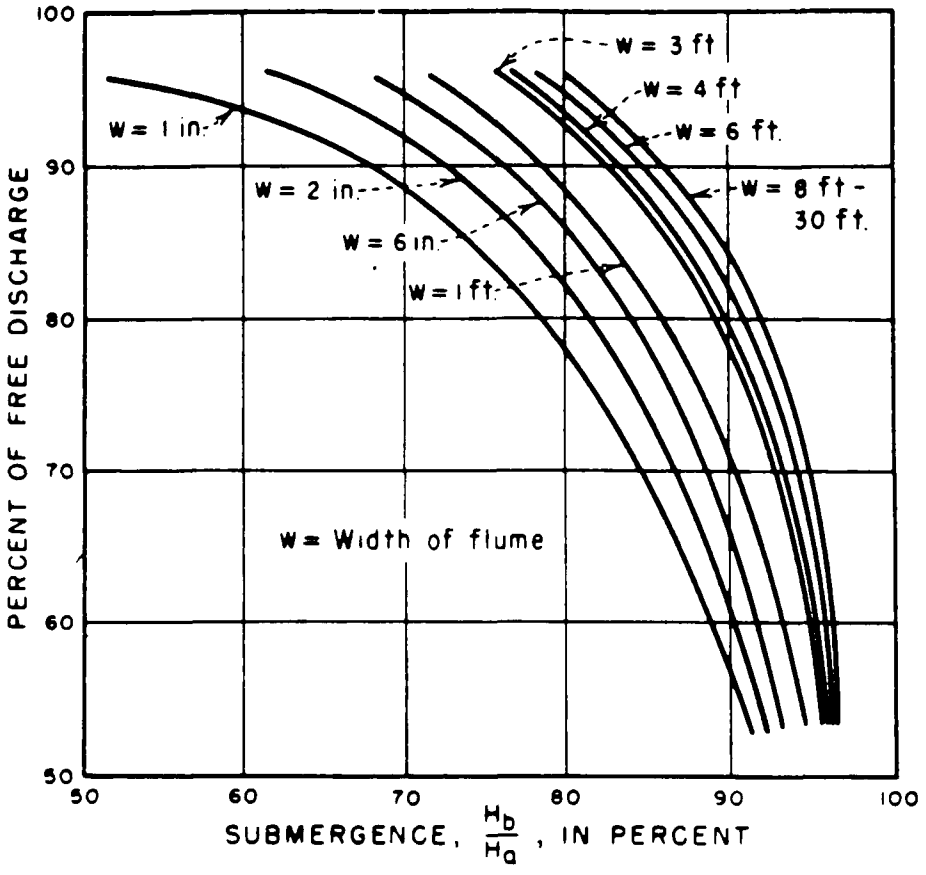


Figure 6-7
Effect of Submergence on Parshall Flume Free Discharge
(Civil Engineering, ASCE)

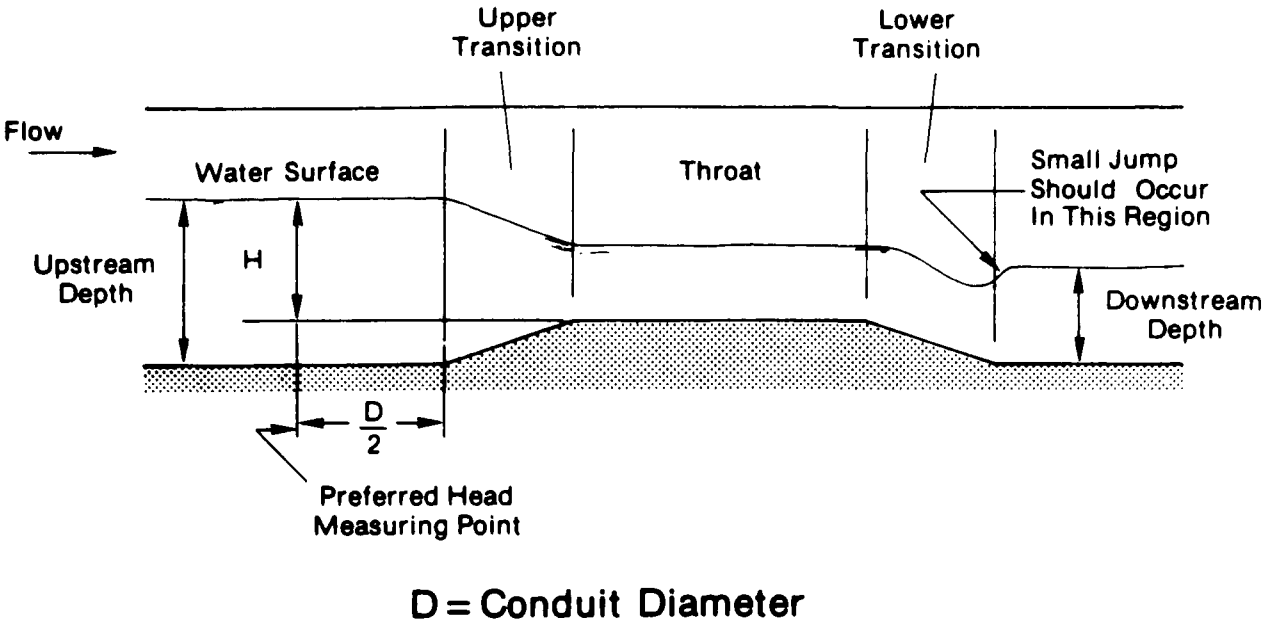


Figure 6-8

Free Flowing Palmer-Bowlus Flume

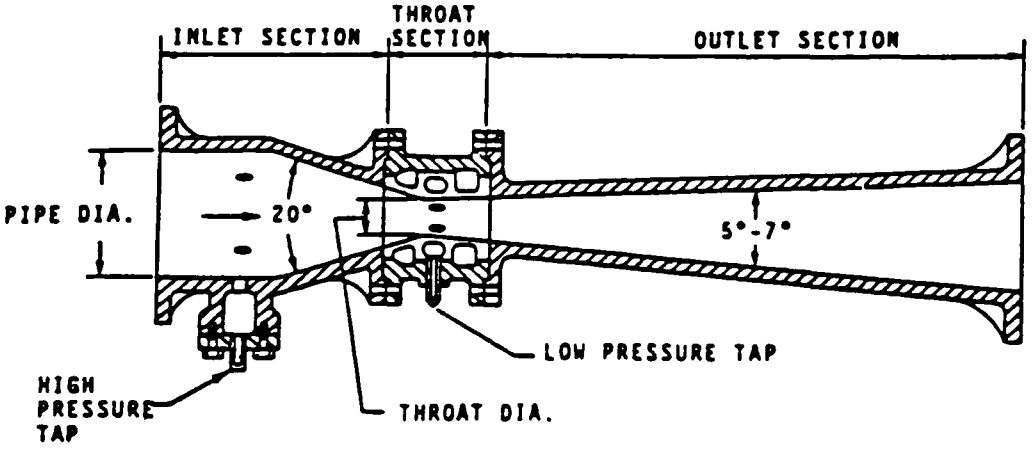


Figure 6-9

Configuration and Nomenclature of Venturi Meter

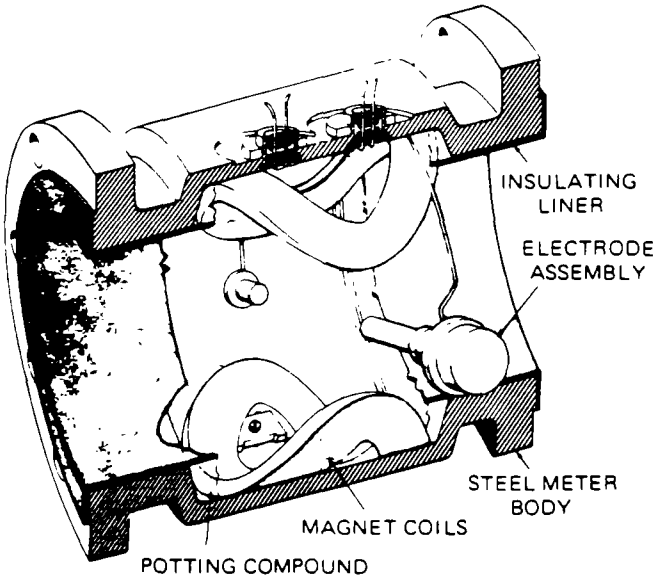


Figure 6-10

Electromagnetic Flowmeter

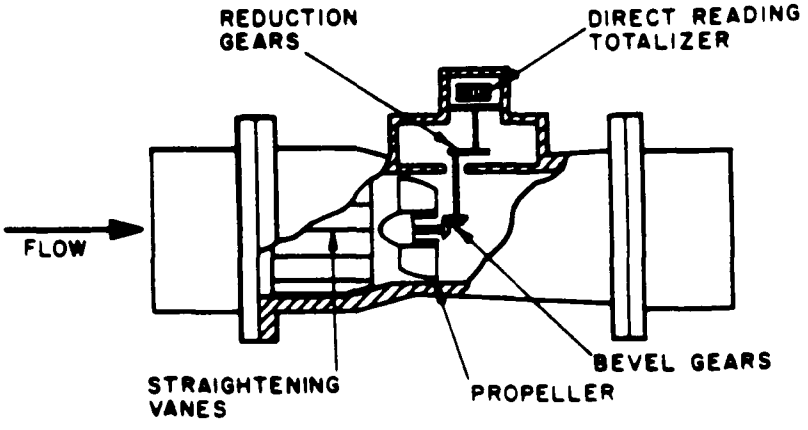


Figure 6-11

Propeller Flowmeter

C FLOW MEASUREMENT COMPLIANCE

Objectives

The current compliance strategy depends heavily on the permittee's submittal of self-monitoring data. The flow discharge measured during the NPDES compliance inspection should verify the flow measurement data collected by the permittee, support any enforcement action that may be necessary, and provide, eventually, a basis for reissuing or revising the NPDES permit.

Flow Measurement System Evaluation

The responsibility of the inspector during NPDES compliance flow measurement inspection includes collecting accurate flow data during the inspection and validating data collected during the permittee's self-monitoring.

The NPDES inspector must check both the permittee's flow data and the flow measurement system to verify the permittee's compliance with NPDES permit requirements. When evaluating a flow measurement system, the inspector should consider and record findings on:

- Whether the system measures the entire discharge flow.
- The system's accuracy and good working order. This will include a thorough physical inspection of the system and comparison of system readings to those obtained with calibrated portable instruments.
- The need for new system equipment.
- The existence or absence of a routine calibration and maintenance program for flow measurement equipment.

If the permittee's flow measurement system is accurate within ±10 percent, the inspector is encouraged to use the installed system. If the flow

sensor or recorder is found to be inaccurate, the inspector should determine whether the equipment can be corrected in time for use during the inspection. If the equipment cannot be repaired in a timely manner, the portable flow sensor and recorder used to assess the accuracy of the permittee's system should be used for the duration of the inspection. If nonstandard primary flow devices are being used, the permittee should supply data on the accuracy and precision of the method being employed.

For flow measurement in pipelines, the inspector may use a portable flowmeter. The inspector should select a flowmeter with an operating range wide enough to cover the anticipated flow to be measured. The selected flowmeter should be tested and calibrated before use. The inspector should select the site for flow measurement according to permit requirements and install the selected flowmeter per the manufacturer's specifications. The inspector should use the proper tables, charts, and formulas as specified by the manufacturer to calculate flow rates.

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.

In the following sections, procedures are presented 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. It must be emphasized that the number of primary/secondary device permutations is limitless. Therefore, it is not feasible to provide procedures for all systems. When systems other than those discussed here are encountered, the inspector is strongly encouraged to consult the manufacturers for advice before preparing a written inspection procedure.

Primary Device Inspection Procedures

The two most common open channel primary devices are sharp-crested weirs and Parshall flumes. Common sources of error when using them include:

- Faulty fabrication--weirs may be too narrow or not "sharp" enough. Flume surfaces may be rough or critical dimensions may exceed tolerances or throat walls may not be vertical.
- Improper installation--weirs and flumes may be installed too near pipe elbows, valves, or other sources of turbulence. The devices may be out of level or plumb.
- Sizing errors--the primary device's recommended applications may not include the actual flow range.

- Poor maintenance--primary devices corrode and deteriorate. Debris and solids may accumulate in them.

Specific inspection procedures for the sharp crested weir, the Parshall flume, and the Palmer-Bowlus flume devices follow.

Sharp-Crested Weir Inspection Procedures

- Inspect the upstream approach to the weir

  - Verify that the weir is perpendicular to the flow direction.
  - Verify that the approach is a straight section of conduit with a length at least 20 times the maximum expected head of liquid above the weir crest.
  - Observe the flow pattern in the approach channel. The flow should occur in smooth stream lines without velocity gradients and turbulence.
  - Check the approach, particularly in the vicinity of the weir, for accumulated solids, debris, or oil and grease. The approach must have no accumulated matter.

- Inspect the weir

  - Verify that the crest of the weir is level across the entire conduit traverse.
  - Measure the width of the weir crest. The edge of the weir crest should be no more than 1/8-inch thick.
  - Make certain the weir crest corresponds to zero gauge elevation (zero output on the secondary device).
  - Measure the angle formed by the top of the crest and the upstream face of the weir. This angle must be 90 degrees.
  - Measure the chamfer on the downstream side of the crest. The chamfer should be approximately 45 degrees.
  - Visually survey the weir-bulkhead connection for evidence of leaks or cracks which permit by-pass.
  - Measure the height of the weir crests above the channel floor. The height should be at least twice the maximum expected head of liquid above the crest.
  - Inspect the weir for evidence of corrosion, scale formation, or clinging matter. The weir must be clean and smooth.
  - Observe flow patterns on the downstream side of the weir. Check for the existence of an air gap (ventilation) immediately adjacent to the downstream face of the weir. Ventilation is necessary to prevent a vacuum that can induce errors in head measurements. Also ensure that the crest is higher than the maximum downstream level of water in the conduit.
  - Verify that the nappe is not submerged and that it springs free of the weir plate.
  - If the weir contains a V-notch, measure the apex angle. The apex should range from 22.5 degrees to 90 degrees. Verify that the head is between 0.2 and 2.0 feet. The weir should not be operated with a head of less than 0.2 feet since the nappe may not spring clear of the crest.

King's Handbook of Hydraulics, 1963, frequently referenced throughout this chapter provides a detailed discussion on weirs.

Parshall Flume Inspection Procedures

- Inspect the flume approach

  - The flow pattern should be smooth with straight stream lines, be free of turbulence, and have a uniform velocity across the channel.
  - The upstream channel should be free of accumulated matter.

- Inspect the flume

  - The flume should be located in a straight section of the conduit.
  - Flow at the entrance should be free of "white" water.
  - The flume should be level in the transverse and translational directions.
  - Measure the dimensions of the flume. Dimensions are strictly prescribed as a function of throat width (see Figure 6-5 for critical dimensions).
  - Measure the head of liquid in the flume and compare with the acceptable ranges in Table 6-4.

- Inspect the flume discharge

  - Verify that the head of water in the discharge is not restricting flow through the flume. The existence of a "standing wave" is good evidence of free flow and verifies that there is no submergence present.

  - Verify whether submergence occurs at or near maximum flow.

Palmer-Bowlus Flume Inspection Procedures

- Inspect the flume approach as outlined above (these flumes are seldom used for effluent flow measurement).

- Inspect the flume

  - The flume should be located in a straight section of the conduit.
  - Flow at the entrance should be free of "white water."
  - Observe the flow in the flume. The profile should approximate that depicted in Figure 6-8.
  - The flume should be level in the transverse direction and should not exceed the translational slope in Table 6-6.
  - Measure the head of water in the flume. Head should be within the ranges specified in Table 6-6.

- Inspect the flume discharge

  - Verify that free flow exists. Look for the characteristic "standing wave" in the divergent section of the flume.

Venturi Meter Inspection Procedures

- Verify that Venturi meter is installed according to manufacturer's instructions.

- Verify that Venturi meter is installed downstream from a straight and uniform section of pipe, at least 5 to 20 diameters, depending on the ratio of pipe to throat diameter and whether straightening vanes are installed upstream. (Installation of straightening vanes upstream will reduce the upstream piping requirements.)

- Verify that the pressure measuring taps are not plugged.

- Calibrate Venturi meter in place by either volumetric method or comparative dye dilution method to check the manufacturer's calibration curve or to develop a new calibration curve.

Secondary Device Inspection Procedures

Common sources of error in the use of secondary devices are:

- Improper location--gauge is located in the wrong position relative to the primary device
- Inadequate maintenance--gauge is not serviced regularly
- Incorrect zero setting--zero setting of gauge is not the zero point of the primary device
- Operator error-human error in reading.

Specific inspection procedures follow.

Flow Measurement in Weir Applications

- Determine that the head measurement device is positioned 3 to 4 head lengths upstream of a weir
- Verify that the zero or other point of the gauge is equal to that of the primary device.

The inspector should use an independent method of measuring head, such as with a yardstick or carpenter's rule (be sure to measure at least 4 H_{max} upstream and convert to nearest hundredth of a foot). To determine flow rate use the appropriate head discharge relationship formula (see Table 6-1).

Flow Measurement in Parshall Flume Applications

Flow Measurement--Free-Flow Conditions.

- Determine upstream head (H_a) using staff gauge

  - Verify staff gauge is set to zero head. A yardstick or carpenter's rule can be used.

  - Verify staff gauge is at proper location (two-thirds the length of the converging section back from the beginning of the throat)
  - Read to nearest division the gauge division at which liquid surface intersects gauge
  - Read H_a in feet from staff gauge.

- To determine flow rate, use Figure 6-6 in the unit desired, or use tables published in flow measurement standard references, or calculate using the coefficients in Table 6-5.

Flow Measurement--Submerged-Flow Condition.

Generally, it is difficult to make field measurements with submerged-flow conditions. In cases when measurements can be obtained (using a staff or float-gauge), the procedures listed below should be followed:

- Determine upstream head using staff or float gauge

  - Read to nearest division and, at the same time as for H_b, the gauge division at which liquid surface intersects gauge
  - Calculate H_a from gauge reading

- Determine downstream head (H_b) using staff or float gauge

  - H_b refers to a measurement at the crest
  - Read to nearest division, and at the same time as for H_a, the gauge division at which liquid surface intersects gauge
  - Calculate H_b from staff reading

- Determine flow rate

  - Calculate percent submergence $\left[\frac{H_b}{H_a}\right] \times 100$
  - Consult Table 6-6
  - When a correction factor is obtained, use H_a and find free-flow from Figure 6-6
  - Multiply this free-flow value by the correction factor to obtain the submerged flow.

The inspector may use an independent method of measuring head, such as a yardstick or carpenter's rule at the proper head measurement

point. Due to the sloping water surface in the converging section of a flume, it is essential that the proper head measurement point be used.

Flow Measurement in Palmer-Bowlus Flume Applications

- Obtain head measurements as in the Parshall Flume application, using the secondary device. The head is the height of water above the step. The total depth upstream of the step is not the head.

- Refer to manufacturer-supplied discharge tables to convert head measurements to flow data. Palmer-Bowlus flumes, unlike Parshall flumes, are not constructed to rigid dimensional standards. The inspector must not use discharge tables supplied by other manufacturers.

Verification

Most flow measurement errors result from inadequate calibration of the flow, totalizer and recorder. If the inspector has determined that the primary device has been installed properly, verification of the permittee's system is relatively simple. The flow determined from the inspector's independent measurement is compared to the flow of the permittee's totalizer or recorder. The inspector's flow measurements should be within 10 percent of the permittee's measurements to certify accurate flow measurement. Optimally, flow comparisons should be made at various flow rates to check system accuracy.

When the permit requires that the daily average flow be measured by a totalizing meter, the inspector should verify that the totalizer is accurate, i.e., properly calibrated. This can be done during a period of steady flow by reading the totalizer and at the same time starting a stop watch. The stop watch should be started just as a new digit starts to appear on the totalizer. After ten to thirty minutes, the totalizer should be read again, just as a new digit begins to appear, the stop watch is read. By subtraction of the two totalizer readings, the total flow over the measured time period can be obtained. The flow rate in gallons per minute can be calculated by using the time from the stop watch. This flow rate should be compared to the flow determined by actual measurement of the head made at the primary device at the time interval. The calibration of the totalizer should be considered satisfactory if the two flows are within ten percent of each other, when the actual measured flow is used as the known value, or divisor, in the percent calculation.

D REFERENCES AND FLOW MEASUREMENT INSPECTION CHECKLIST

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FLOW MEASUREMENT INSPECTION CHECKLIST

A. GENERAL

Yes No N/A	1. a. Primary flow measuring device properly installed and maintained.
Yes No N/A	b. Flow measured at each outfall? Number of outfalls? _____
Yes No N/A	c. Is there a straight length of pipe or channel before and after the flowmeter of at least 5 to 20 diameters?
Yes No N/A	d. If a magnetic flowmeter is used, are there sources of electric noise in the near vicinity?
Yes No N/A	e. Is the magnetic flowmeter properly grounded?
Yes No N/A	f. Is the full pipe requirement met?
Yes No N/A	2. a. Flow records properly kept.
Yes No N/A	b. All charts maintained in a file.
Yes No N/A	c. All calibration data entered into a log book.
Yes No N/A	3. Actual discharged flow measured.
Yes No N/A	4. Effluent flow measured after all return lines.
Yes No N/A	5. Secondary instruments (totalizers, recorders, etc.) properly operated and maintained.
Yes No N/A	6. Spare parts stocked.
Yes No N/A	7. Effluent loadings calculated using effluent flow.

B. FLUMES

Yes No N/A	1. Flow entering flume reasonably well-distributed across the channel and free of turbulence, boils, or other disturbances.
Yes No N/A	2. Cross-sectional velocities at entrance relatively uniform.
Yes No N/A	3. Flume clean and free of debris or deposits.
Yes No N/A	4. All dimensions of flume accurate and level.
Yes No N/A	5. Side walls of flume vertical and smooth.
Yes No N/A	6. Sides of flume throat vertical and parallel.
Yes No N/A	7. Flume head being measured at proper location.
Yes No N/A	8. Measurement of flume head zeroed to flume crest.
Yes No N/A	9. Flume properly sized to measure range of existing flow.
Yes No N/A	10. Flume operating under free-flow conditions over existing range of flows.

FLOW MEASUREMENT INSPECTION CHECKLIST
(Continued)

B. FLUMES (Continued)

Yes No N/A	11. Flume submerged under certain flow conditions.
Yes No N/A	12. Flume operation invariably free-flow.

C. WEIRS

	1. What type of weir is being used?
Yes No N/A	2. Weir exactly level.
Yes No N/A	3. Weir plate plumb and its top and edges sharp and clean
Yes No N/A	4. Downstream edge of weir is champered at 45°.
Yes No N/A	5. Free access for air below the nappe of the weir.
Yes No N/A	6. Upstream channel of weir straight for at least four times the depth of water level and free from disturbances.
Yes No N/A	7. Distance from sides of weir to side of channel at least 2H.
Yes No N/A	8. Area of approach channel at least (8 x nappe area) for upstream distance of 15H.
Yes No N/A	9. If not, is velocity of approach too high?
Yes No N/A	10. Head measurements properly made by facility personnel.
Yes No N/A	11. Leakage does not occur around weir.
Yes No N/A	12. Proper flow tables used by facility personnel.

D. OTHER FLOW DEVICES

	1. Type of flowmeter used:
	2. What are the most common problems that the operator has had with the flowmeter?
	3. Measured wastewater flow: _____ mgd; Recorded flow: mgd; Error %

E. CALIBRATION AND MAINTENANCE

Yes No N/A	1. Flow totalizer properly calibrated.
	2. Frequency of routine inspection by proper operator: /day.
	3. Frequency of maintenance inspections by plant personnel: /year.
Yes No N/A	4. Flow meter calibration records kept. Frequency of flow meter calibration: /month.
Yes No N/A	5. Flow measurement equipment adequate to handle expected ranges of flow rates.
Yes No N/A	6. Calibration Frequency Adequate

Chapter Seven

BIOMONITORING

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Chapter Seven

A EVALUATION OF PERMITTEE SELF-BIOMONITORING PROGRAM

Introduction

This chapter highlights acute and chronic toxicity testing procedures that may be required by a National Pollutant Discharge Elimination System (NPDES) permit. The following section summarizes factors that the inspector should evaluate during the inspection. Then another section lists technical procedures that should be followed by the inspector and/or permittee to conduct effluent toxicity tests. Toxicity tests are one type of biomonitoring. They measure the degree of response produced by exposure to a specific level of stimulus or concentration of chemical(s). The inspector can use this information to guide his or her review of a permittee's self-biomonitoring program or to plan toxicity tests. Detailed procedures for biomonitoring testing are given in the EPA's Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms (EPA 600/4-85/013) and in EPA's Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (EPA 600/4-85/014). Periodically, these procedures will be updated and modified. Refer to the latest revision for specific procedures.

A biomonitoring inspection should include one or more of these objectives:

- Assess compliance with the discharger's NPDES permit limitations and requirements
- Determine whether the records and reports required by the discharger's NPDES permit are being maintained
- Check the adequacy of the permittee's reports
- Determine whether representative samples are being collected and analyzed properly
- Determine whether toxicity tests have been conducted properly
- Determine need for toxicity limits
- Evaluate the permittee's self-biomonitoring program.

Objectives and Requirements

The evaluation of a permittee's biomonitoring program includes a compliance evaluation inspection (CEI) and performance audit inspection (PAI). During a PAI, the inspector must review the performance of permittee staff and evaluate their testing and sampling procedures. A CEI consists of an examination of the permittee's biomonitoring files and records, the toxicity testing laboratory, and sampling records.

For each set of definitive acute toxicity test data, the 24-, 48-, or 96-hour LC50 or EC50 and its 95 percent confidence limits must be calculated on the basis of the initial volume percentage of effluent in the test solutions.

For each set of chronic toxicity data, the no-observed-effect level (NOEL) and confidence limits, as well as statistical comparisons where appropriate, must be calculated to distinguish between control and experimental rates of growth, reproduction, teratogenesis, or other long-term effects.

The inspector should understand a permittee's biomonitoring requirements as stated in the permit and should determine whether or not a permittee's biomonitoring program meets the requirements of the permit. The CEI and PAI procedures for evaluating a permittee's self-biomonitoring program address the following specific objectives:

- Assess compliance with the NPDES permit limitations and requirements (CEI)
- Determine adequacy of required reports and records (CEI)
- Determine adequacy of laboratory facility and equipment (CEI)
- Determine adequacy of effluent sampling and toxicity testing procedures (PAI).

The inspector should observe and review the permittee's laboratory procedures, equipment, facilities, and logs, or those of its contractors. Sampling, facilities, test organisms, procedures, and records require detailed on-site review and evaluation.

Effluent Sampling

Permittees should collect samples of the type and locations specified in their permit. The test protocols should specify how the sample is obtained and treated. The test should be initiated within 36 hours of collection to avoid changes in potency. When evaluating a permittee's sampling program, the inspector should verify that these requirements are fulfilled.

Facilities and Equipment. Effluent toxicity testing may be performed in either a stationary or mobile laboratory. Toxicity testing facilities may include equipment for rearing, holding, and acclimating test organisms. These facilities should be well ventilated and free of fumes. Air supplies

should be free of oil. Dilution water and temperature controls should be high quality. Separated test areas should be provided. If marine organisms are tested, the lab needs a source of saltwater and noncorroding containers. Water temperature should be controlled by the use of circulating water baths, heat exchangers, or environmental chambers during acclimation and testing.

Test Organisms. Table 7-1 identifies species that have been used widely in toxicity tests and are acceptable test organisms. The condition, age, exposure history, and rearing or holding conditions can affect the results. In general, wild stock are unacceptable unless these factors are known.

The inspector should look for discrepancies in the lab data or appearance of the test organisms. For example, test organisms should have a survival rate of at least 80 percent for invertebrates or 90 percent for vertebrates during holding/acclimation (usually 7-14 days before the test). Poor survival during holding periods suggests poor test conditions or poor test organisms. In addition to survival, changes in fecundity and growth can be used to evaluate the health of test organisms and maintenance of the cultures.

Dilution Water. To determine inherent toxicity of a wastewater, a standard reconstituted water normally is used. If the objective of the test is to determine the effect of mixed receiving water and wastewater on the organism, then receiving water or reconstituted water similar in chemical characteristics (particularly for pH and hardness) to the receiving water should be used. If the receiving water has toxic effects on the test organisms, it is unsuitable as dilution water. Another nontoxic source such as a nearby tributary, ground water, or synthetic water must be used and noted. Dilution water from receiving water should be collected as close to the outfall as possible, but it should be collected upstream from or outside the influence of the effluent. Dilution water should be obtained from the receiving water within 96 hours of the test. The inspector should determine whether the source and use of dilution water are adequate in terms of quality and timeliness.

Test Procedures

The most important aspect of the biomonitoring inspection is the observation of permittee or contractor toxicity testing procedures and related laboratory analysis. The inspector should verify that conditions and procedures are correct regarding:

- Control and effluent dilution preparation
- Procedures for transferring, allocating, and feeding test organisms
- Recording of times for test setup and initiation
- Temperature and dissolved oxygen (DO) ranges during the test
- Test organism age, weight, length, and species.

Test Results

The inspector should review test results in the permittee's records. The test reports should include sufficient data to assure that the test results were valid and reflect accurate estimates of effluent toxicity. Test results should provide an estimate of the toxicity, a 95 percent confidence interval, physical/chemical measurements, and observations during the test. The inspector may use Figure 7-1 to evaluate test results or use the questions appearing there as a guide to evaluate test procedures. For details see Section 13 of EPA/600/4-85/013 and Section 10 of EPA/600/4-85/014.

Recordkeeping and Data Reporting

Proper recordkeeping is essential to an effective program. Bound notebooks should be used to maintain detailed records of holding, acclimation, rearing, and other information on equipment calibration, test conditions, and end results. Annotations should be made as soon as possible to prevent the loss of information. Figure 7-1 is a sample form to evaluate effluent toxicity test results and test procedures. When evaluating the permittee's data reporting, the inspector should verify that the following are included:

- Summary of test results, description of test conditions, material tested, and other data for quality assurance (see Figure 7-1)
- Methods used for all chemical analyses
- Average and range of acclimation temperature and test temperature
- Any deviation from standard test methods
- Any other relevant information.

Table 7-1

Recommended Species, Test Temperatures, and Life Stages

Species		Test Temperature (°C)[a]	Life Stages[b]
Freshwater			
Vertebrates			
Cold Water			
Brook trout	Salvelinus fontinalis	12	30-90 days
Coho salmon	Oncorhynchus kisutch	12	30-90 days
Rainbow trout	Salmo gairdnerii	12	30-90 days
Warm Water			
Bluegill	Lepomis machrochirus	20	1-90 days
Channel catfish	Ictalurus punctatus	20	1-90 days
Fathead minnow	Pimephales promelas	20(26)[c]	1-90 days
Invertebrates			
Cold Water			
Stone flies	Pteronarcys spp.	12	Larvae
Crayfish	Pacifastacus leniusculus	12	Juveniles
Mayflies	Baetis spp., Ephemerella spp.	12	Nymphs
Warm Water			
Amphipods	Hyalella spp., Gammarus lacustris, G. fasciatus, G. pseudolimnaeus	20	Juveniles
Cladocera	Daphnia magna, D. pulex,[d] Ceriodaphnia dubia	20(26)[c]	1-24 h
Crayfish	Orconectes spp., Cambarus spp., Procambarus spp.	20	Juveniles
Mayflies	Hexagenia limbata, H. bilineata	20	Nymphs
Midges	Chironomus spp.	20	Larvae

Source: U.S. Environmental Protection Agency. 1985. Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms, 3rd ed. EPA 600/4-85/013.

[a]To avoid unnecessary logistical problems in trying to maintain different test temperatures for each test organism, it is sufficient to use one temperature (12°C) for cold water organisms and one temperature (20°C) for warm water organisms. See Note (c) for exceptions.
[b]The optimum life stage is not known for all test organisms.
[c]Short-term subchronic test procedures (EPA 600/4-85/014, revised edition) require 26°C with a minimum of 25°C.
When specific temperatures are cited in a protocol, they should be used.
[d]Daphnia pulex is recommended over D. magna because it is more widely distributed in the United States, test results are less sensitive to feeding during tests, and it is not as easily trapped on the surface film.

Table 7-1

Recommended Species, Test Temperatures, and Life Stages (Continued)

Species		Test Temperature (°C)	Life Stage
Marine and estuarine			
Vertebrates			
Cold Water			
English sole	Parophrys vetulus	12	1-90 days
Sand dab	Citharichthys stigmaeus	12	1-90 days
Winter flounder	Pseudopleuronectes americanus	12	Post-metamorphosis
Warm Water			
Flounder	Paralichthys dentatus, P. lethostigma	20	1-90 days
Longnose killifish	Fundulus similis	20	1-90 days
Mummichog	Fundulus heteroclitus	20	1-90 days
Pinfish	Lagodon rhomboides	20	1-90 days
Sheepshead minnow	Cyprinodon variegatus	20	1-90 days
Silversides	Menidia spp.	20	1-90 days
Spot	Leiostomus xanthurus	20	1-90 days
Three-spined stickleback	Gasterosteus aculeatus	20	1-90 days
Invertebrates			
Cold Water			
Dungeness crab	Cancer magister	12	Juvenile
Oceanic shrimp	Pandalus jordani	12	Juvenile
Green sea urchin	Strongylocentrotus drobachiensis	12	Gametes/embryo
Purple sea urchin	S. purpuratus	12	Gametes/embryo
Sand dollar	Dendraster excentricus	12	Gametes/embryo
Warm Water			
Blue crab	Callinectes sapidus	20	Juvenile
Mysid	Mysidopsis spp., Neomysis spp.	20	1-5 days
Grass shrimp	Palaemonetes spp.	20	1-10 days
Peneid shrimp	Peneus setiferus, P. duorarum, P. axtecus	20	Post larval
Sand shrimp	Crangon spp.	20	Post larval
Pacific oyster	Crassostrea gigas	20	Post larval
American oyster	Crassostrea virginica	20	Embryo/larval

Permit No.: _____

Facility Name: _____ Laboratory Name: _____
Facility Location: _____ Investigator's Name: _____

Toxicity Test

Acute Toxicity Test: 24-Hour Static __ 48-Hour Static __ Daily Renewal __
96-Hour Flow-through __ 96-Hour Static __

Chronic Toxicity Test: 4-Day Static __ 7-Day Static Renewal __
8-Day Static Renewal __ Other (Specify) _____
Renewal Frequency (specify test days) _____

Test Starting Date: _____ Completion Date: _____
Test Temperature: _____
Test Organism: _____ Age (Hours or Days) _____
Name: _____

Summary of Results

Acute Toxicity Test:

Stress Observed (Yes or No)	Mortality Observed (Yes or No)	LC50 (% effluent)	Other (Specify)
_____	_____	_____	_____

Chronic Toxicity Test:

Characteristic	NOEL	LOEL	Control/___%	Effluent
Survival				
Growth				
Reproduction (Young/Female)				
Hatch				
Tetrogenesis				

Figure 7-1

NPDES Toxicity Test Evaluation Form

Quality Assurance Summary	Acceptable	Unacceptable
Is temperature maintained during tests within ±2°C of the test temperature except for *Ceriodaphnia*, for which the temperature is kept ±1°C of the specified level?	Yes _____	No _____
Are DO levels always greater than 40% saturation for warm water species and 60% saturation for cold water species?	Yes _____	No _____
At a minimum, is a summary of responses for each test concentration and control maintained?	Yes _____	No _____
Is the loading factor for all exposure chambers less than or equal to the maximum allowed for the test type and test temperature?	Yes _____	No _____
Does the water chemistry vary during the test?	Yes _____	No _____
If contaminant-free water is required, do healthy test organisms survive in the dilution water without signs of stress and does mortality not exceed 10% during the acclimation period?	Yes _____	No _____
Is the control survival 90% or greater for acute tests and 80% or greater overall for chronic tests?	Yes _____	No _____
If tests are replicated, with a dilution factor of 0.5, does the point estimate of NOEL, assuming it falls within the range of the LOEC, have a coefficient of variation of ±10%?	Yes _____	No _____
Are reference toxicant tests used and are the results in the acceptable range?	Yes _____	No _____

Effluent Tested

Sampling Location(s): _____ Type of Sample: _____
Sample Collection Dates/Times: _____

Dilution Water

Source _____ Collection Date(s) _____

Figure 7-1

NPDES Toxicity Test Evaluation Form (Continued)

B COMPLIANCE BIOMONITORING INSPECTION

Objectives and Requirements

The objectives of a compliance biomonitoring inspection are to:

- Screen for toxic conditions not yet detected in an effluent
- Evaluate compliance with water quality standards
- Monitor toxic compounds that may or may not be controlled through economically achievable best control technology/best available technology (BCT/BAT) practices
- Evaluate permit limitations
- Develop enforcement cases
- Investigate probable cause violations
- Develop data for establishing new effluent limitations.

Conducting Toxicity Tests

A toxicity testing program is conducted by the regulatory agency to evaluate an effluent. The toxicity tests can be conducted on- or off-site.

On-site biomonitoring may involve the following toxicity tests:

- Acute toxicity tests

  - An 8- to 24-hour range-finding (screening) test
  - A 24- to 96-hour static test
  - A 96-hour, flow-through test
  - A 24-hour quality assurance test with a referenced toxicant
  - Other effluent testing (e.g., fractionation, persistence).

- Chronic toxicity tests

  - Range-finding tests
  - Acute tests with a reference toxicant (run concurrently with a chronic test)

- Short-term chronic tests (either static, static renewal, or flow-through)
- Other effluent testing procedures (e.g., instream toxicity, relative toxicity).

Off-site biomonitoring usually involves:

- Collecting an effluent sample (a grab sample or a 24-hour composite sample)
- Transporting the sample to EPA or to State laboratories
- Performing any of the above tests.

Effluent Sampling and Holding

The effluent sampling point must be the same as that specified in the NPDES permit. However, different locations may be used to evaluate individual wastestreams. A sample should represent the "normal and typical" discharge and operating conditions of the facility. Toxicity tests should be initiated within 36 hours of sample collection for non-persistent effluents and within 72 hours for persistent effluents (EPA/600/4-85/013).

Effluent variability may be estimated from a review of self-monitoring or by continuously monitoring parameters such as pH or conductivity. From these data, a mean and standard deviation may be calculated (Note pH is logarithmic). If the coefficient of variability (i.e., the standard deviation divided by the mean) exceeds 0.5, the wastewater is highly variable. This variability should be addressed in the type of exposure during the test (flow through versus static) as well as the sample collection regime used.

Effluent grab samples must be stored in covered, unsealed containers. Although it is desirable to refrigerate samples before testing them, it is often convenient to store them in a constant-temperature water bath or controlled environment room at the temperature at which the test will be conducted. The test should be initiated as soon as possible, but no later than 36 hours (or 72 hours, if persistent) after sample collection.

The persistence of an effluent's toxicity may be a factor in determining specific toxicity limits in a NPDES permit, and it is determined by measuring the effluent toxicity at collection and again after holding the sample for 96 hours. If after holding the effluent 96 hours its toxicity has not decreased by 50 percent or more, it is classified as persistent. (When special tests such as persistence are conducted, the exact methodology must be detailed in the report.)

Flow-through Tests. These procedures are generally appropriate for acute tests. If the permittee facility discharges continuously, the effluent should be pumped directly and continuously from the discharge line to the dilutor system for the duration of the test. If the effluent cannot be pumped directly and continuously to the dilutor system, the following alternative methods may be used to collect it:

- When the calculated retention time of the effluent is less than 14 days, a minimum of two grab samples are collected daily (e.g., 8:00 a.m. and 4:00 p.m.). The freshly collected effluent should not be combined with effluent remaining from a previously collected sample. The remainder of the previously collected sample is discarded, and the container is refilled with fresh effluent.

- When the calculated retention time of the effluent is 14 days or greater, a single grab sample of sufficient volume to supply the dilutor for 24 hours is collected daily. The volume of the sample remaining from the previous day is discarded and replaced by the fresh sample (renewal).

If the permittee's discharge is intermittent, use one of the following procedures:

- When a continuous discharge occurs during a single 8-hour work shift or two successive 8-hour work shifts, at least one grab sample of sufficient volume to supply the dilutor for 24 hours is collected daily, midway in the discharge period.

- When the facility retains the wastewater during an 8-hour work shift, and then treats and releases it as a batch discharge, a single grab sample of sufficient volume to last 24 hours is collected daily from each discharge during the test period.

- When the facility discharges wastewater to an estuary only during an outgoing tide, a single grab sample of sufficient volume to last 24 hours is collected during one discharge period every 24 hours for the duration of the test. An alternative sampling method would be to place the effluent sampling pump in the final waste lagoon adjacent to the discharge pipe so that a continuous source of effluent would be available for testing.

Static Tests. Static tests are appropriate for both acute and chronic testing. Sampling recommendations are discussed for both types of static test conditions--nonrenewal and renewal. For nonrenewal conditions appropriate for some acute testing, effluent samples are collected only at the beginning of the effort. For renewal tests appropriate for non-persistent effluents and most chronic toxicity tests, samples are collected to renew the test solutions regularly throughout the test period.

If the facility discharge is continuous, use one of the following approaches:

- If the calculated retention time is less than 14 days and the variability of the waste is unknown, use one of the approaches identified below:

  - Nonrenewal tests: A minimum of two separate grab samples are collected over the first 24-hour period and used in separate tests to determine the variability in toxicity by comparison of the results

- Renewal tests: A minimum of two separate grab samples are collected over the first 24-hour period. Each sample is used in a separate test that begins on the first day and is renewed daily.

- If the calculated retention time is greater than 14 days, or if it can be demonstrated that the wastewater does not vary in chemical composition or concentration regardless of holding time, use one of the following approaches:

  - Nonrenewal tests: A minimum of one grab sample is collected and used in a single test
  - Renewal tests: A minimum of one grab sample is collected each day, or as specified in the test procedure, and used to renew the test solutions.

If the facility discharge is intermittent, use one of the following approaches:

- When the effluent is discharged continuously during a single 8-hour work shift or two consecutive 8-hour work shifts, a minimum of one grab sample is collected midway in the discharge period and used in a single nonrenewal test, or a grab sample may be collected daily for a renewal test.

- When the facility retains the wastewater during an 8-hour work shift, then treats and releases it as a batch discharge, a grab sample is collected for a single nonrenewal test, or a grab sample is collected daily for a renewal test.

- When the facility discharges wastewater to an estuary only during an outgoing tide, a grab sample is collected during a discharge period for use in a single nonrenewal test, or a grab sample is collected daily for a renewal test.

- At the end of the shift, cleanup activities may result in the discharge of a slug of toxic waste. It would be advisable, therefore, to consider collecting a sample at that time and conducting a separate toxicity test.

Test Organisms

The inspector should determine whether the following test organism criteria are observed by the laboratory:

- Test organisms of the appropriate age are used. Juvenile fish (one to 90 days old) are required (7-14 days are preferred) for acute toxicity testing. Chronic toxicity tests with the fathead minnow (*Pimephales promelas*) and the cladoceran (*Ceriodaphnia dubia*) require neonates that are less than 24-hours old. A stock culture 7- to 10-days old is preferred for chronic toxicity testing with alga (*Selenastrum capricornutum*).

- Test organisms are fed according to the requirements for the particular type of test:

  - Problems caused by feeding, such as the possible alteration of the toxicant concentration and the buildup of food and metabolic wastes, with the concomitant increase in oxygen demand, are common in static test systems. When feeding is necessary, excess food should be removed daily by aspirating with a pipette.
  - Feeding does not cause the above problems in flow-through systems. However, it is advisable to remove excess food, fecal material, and any solids that may have settled from the effluent to the bottom of the test vessels daily by aspirating them with a pipette.

- A daily log of feeding, mortality, and observations.

- Observes the following procedures for holding test organisms:

  - Quarantines new test organisms for at least 10 days if received from an outside source of unknown quality or 48 hours if test organisms are obtained from a quality stock.
  - Ensures a gradual acclimation. Maximum changes permitted are 3°C in water temperature, or 3 0/00 in salinity in a 12-hour period; or total change of 6°C, 6 0/00 salinity or 2.0 pH units.
  - Maintains DO levels above 40 percent saturation for warm water species and above 60 percent saturation for cold water species.

- Records source of test organisms (hatchery, in-house, or elsewhere), as well as holding conditions (temperature, dissolved oxygen).

- Handles test organisms as little as possible to minimize stress:

  - Dip nets should be used for large organisms
  - Pipettes should be used for transferring small organisms such as daphnids and midge larvae.

Facility and Equipment

General Requirements. Effluent toxicity tests may be done in a fixed or mobile laboratory. Depending on the scope of the toxicity testing program, facilities may include equipment for rearing, holding, and acclimating organisms. Temperature control is achieved using circulating water baths, heat exchangers, or environmental chambers. Appropriate dilution water may be ground water, surface water, reconstituted water, or dechlorinated tap water. Holding, acclimation, and dilution water should be temperature controlled and aerated whenever possible. Air used for aeration must be free of oil and fumes; filters to remove oil in water are desirable. Test facilities must be well ventilated and free of fumes. During holding, acclimating, and testing, test organisms should be shielded from external disturbances.

Some organisms may have special environmental requirements, such as flowing water, fluctuating water levels, or particular substrate, that must be provided. During holding, acclimating, and testing, immature stream insects always should be in flowing water, as described by Nebeker and Lemke (1968); peneid shrimp and bottom-dwelling fish should be provided a sandy substrate. Since cannibalism can occur among many species of arthropods, these organisms should be isolated by some means (e.g., with screened compartments). The claws of crabs and crayfish should be bound.

Construction Materials. Tempered glass, No. 304 (for freshwater) or No. 316 or higher (for salt water) stainless steel, and perfluorocarbon plastics (TEFLON®) should be used in the construction of test equipment whenever possible. Linear polyethylene also may be used with some types of effluents, but it should be avoided with effluents containing synthetic organic compounds or pesticides. Unplasticized plastics, such as polyethylene, polypropylene, TYGON®, and fiberglass, can be used for holding, acclimating, and dilution-water storage tanks, and in the water delivery system. Copper, galvanized material, rubber, brass, and lead must not contact holding, acclimation, or dilution water, or effluent samples and test solutions.

Effluent Delivery System (Flow-through Test Only). The flow-through proportional-dilutor delivery system has proved the best system for routine effluent toxicity tests conducted in fixed and mobile laboratories. Dilutors with a solenoid valve system are preferred, but the vacuum siphon system is acceptable if funds are limited.

The flow rate through the proportional dilutor must provide for at least 5 complete water changes in 24 hours per chamber, plus sufficient flow to maintain an adequate DO concentration. The flow rates through the test chambers should not vary by more than 10 percent among test chambers at any time during any test. The dilutor also should be capable of maintaining the test concentration in each test chamber within 5 percent of the initial value for the test duration. The dilutor should be checked and calibrated before and after each test.

Test Chambers. Test chambers used in flow-through tests usually are constructed of one-fourth inch plate glass held together with clear silicone adhesive. All joints should be smooth. Stainless steel (No. 304 or No. 316) can be used in the construction of test chambers, but it must be welded, not soldered. Plastic chambers can be used, but they may be rinsed with dilution water prior to testing and should be discarded after the test.

Test chambers most commonly used in static tests are widemouthed 3.8-liter (1-gallon) or 19.0-liter (5-gallon) soft-glass bottles or aquariums. Short-term subchronic toxicity test materials for *Ceriodaphnia dubia* include the use of unwashed disposable plastic. Containers such as 10- to 20-cm diameter culture dishes or beakers may be more suitable as test chambers for fish eggs and/or larvae and small crustaceans. Special glass or stainless steel test chambers can be constructed to accommodate test organisms requiring special physical conditions. These chambers should be covered and provided with 5 cm of test solution. Algal tests require constant but gentle agitation or shaking in special culture flasks.

Dilution Water. The source of dilution water used in the tests will depend largely on the objectives of the study. It is recommended that a standard dilution water be used to determine the inherent toxicity of the effluent or to monitor compliance with a limit. For on-site flow through tests, such large quantities of water are required that upstream receiving waters or ground water sources are most practical. If the objective of the test is to determine the effect of multiple point sources, it is desirable to use receiving water as the dilution water even when it is contaminated by "upstream" sources of toxic substances. In this case, an uncontaminated dilution water source must be used as the control to distinguish between observed toxicity due to the effluent and that due to the dilution water.

When the dilution water is taken from the receiving water, it should be collected at a point as close as possible to the outfall, but upstream from or outside of the influence of the effluent. In an estuary, the dilution water should have the same salinity as water at the receiving site. It should be collected at slack high tide or within 1 hour after high tide. The water should be collected immediately before the test, and never more than 96 hours earlier. The sample should be chilled to 4°C during or immediately after collection and maintained at that temperature until used.

If contaminant-free water is required for acute toxicity testing, dilution water is acceptable if healthy organisms survive in it without showing stress and their mortality does not exceed 10 percent during the acclimation period. Dilution water is considered acceptable for chronic toxicity testing if test organisms show adequate survival, growth, and reproduction in the controls during the study.

Except for chronic toxicity testing, pretreatment of dilution water should be limited to filtration through a nylon sieve having 2- to 4-millimeter openings to remove debris and/or break up large floating or suspended solids. If a mini-dilutor employing capillary delivery tubes is used, it may be necessary to filter the effluent through glass wool before it enters the dilutor system. With Ceriodaphnia and Pimephales (fathead minnow) tests, effluents and surface waters must be filtered through a 30-micron plankton net to remove indigenous organisms that could attack the test organisms. Surface waters used in algal toxicity tests must be filtered through a 0.45-micron pore diameter filter before use.

If the receiving water is unsuitable to use as dilution water, use "reconstituted" water. Saltwater media such as INSTANT OCEAN®, 40 fathoms®, and Hawaiian Mix® are available commercially. Recommended procedures for preparing "reconstituted" water are given in Methods for Measuring the Acute Toxicity of Effluents to Freshwater and Marine Organisms (EPA 600/4-85/013) and Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (EPA 600/4-85/014).

Test Procedures

Range-finding (Screening) Test. It may be necessary to conduct an abbreviated, preliminary, range-finding, or screening test to determine the concentrations necessary for definitive tests. Screening can be

a static or a flow-through test. Static tests use five organisms in 3 to 5 effluent dilutions and a control, for 8 to 24 hours. If the range-finding test is to be conducted with the same sample of effluent as that used in the definitive test, the duration of the range-finding test cannot exceed 24 hours and the definitive test must begin within 36 hours of sample collection.

Definitive Test. The determination of the adverse effects of toxicants must employ a control and at least five concentrations of effluent in an exponential series.

If 100 percent effluent does not, in an acute toxicity test, kill (or affect) more than 50 percent of the organisms exposed to it, the percentage of organisms killed (or affected) by various levels of the effluent in the receiving water must be reported. A test is not acceptable if control mortality exceeds 10 percent in controls for acute tests and 20 percent overall for chronic tests.

Chronic tests generally are used to establish "no effect" levels of effluents or mixtures of effluents and receiving waters. Although the chronic testing is designed to evaluate quantifiable changes in such characteristics as growth or reproduction, qualitative observations or differences in behavior or appearance are also important. Appropriate test procedures must be used and acceptable conditions maintained throughout the test for the results to be valid.

Number of Test Organisms. For acute toxicity testing, at least 20 organisms of a given species must be exposed to each treatment in two or more replicates. The numbers vary for chronic toxicity testing, from 1 *Ceriodaphnia* in 10 replicates for a survival and reproduction test to 20-50 fathead minnow embryos (*Pimephales promelas*) in 2 replicates for a survival and teratogenicity test. An initial cell density of 10,000 cells/ml is required in three replicates for the alga (*Selenastrum capricornutum*) growth test. To qualify as true replicates, no water connection can exist between replicate test chambers.

Loading of Test Organisms (Acute Tests). For flow-through tests, loading in the test chambers must not exceed 5 grams per liter at temperatures of 20°C or less, or 2.5 grams per liter at temperatures above 20°C.

For both renewal and nonrenewal static tests, loading in the test chambers must not exceed 0.8 grams per liter at temperatures of 20°C or less and 0.4 grams per liter at temperatures above 20°C.

Water Temperature. Maintain the water temperature within ±2.0°C of the recommended temperature except for *Ceriodaphnia*, for which the temperature must be kept ±1°C of the specified level.

Dissolved Oxygen. Avoid aeration that may alter the results of toxicity tests. However, the DO concentration in the test solution must exceed 40 percent saturation for warm water species and 60 percent saturation for cold water species. The turnover rate of the solutions in the test chambers may be increased to maintain acceptable DO levels. If the increased turnover rate does not maintain adequate DO levels, dilution water must be aerated. For effluents with chronically low DO, flow through testing is recommended rather than aeration. Aeration is only a last resort.

Synthetic Water. Synthetic moderately hard water (hardness of 80 to 100 mg/l as $CaCO_3$) is recommended as a standard medium for tests using Ceriodaphnia. MiliQ® or equivalent types of water treatment are recommended to provide adequate quality for dilution water.

Beginning the Test. The test begins when the test organisms are first exposed to the effluent.

- Flow-through test: The dilutor system should be in operation 24 hours before test organisms are added and the test begins. During this period, effluent volumes, temperature, and flow rates are adjusted.

- Static test: The effluent is added to the dilution water and mixed well by stirring with a glass rod. The test organisms are placed in the chambers within 30 minutes.

Feeding the proper amount of the right food is extremely important in Ceriodaphnia culturing. The key is to provide sufficient nutrition to support normal reproduction without adding excess food that might clog the animal's filtering apparatus, or greatly decrease the concentration of DO, and cause the animals to die. Feeding procedures for Ceriodaphnia are detailed in Methods for Estimating the Chronic Toxicity of Effluents and Receiving Waters to Freshwater Organisms (EPA 600/4-85/014).

Duration. Depending on the test organisms used, the purpose of the test, and the type (range-finding or definitive), the duration of acute toxicity tests may range from 8 to 96 hours. Methodology now permits short-term (4- to 8-day) chronic toxicity tests.

Reference Toxicants

Reference toxicants are used to establish the relative sensitivity of the test organisms. A laboratory performs a definitive 24- or 48-hour static toxicity test with the reference toxicant to establish an average response. The LC50 of a batch of test organisms can be evaluated against the laboratory's control charts (USEPA 1979). For example, if the LC50 of a reference toxicant is not in the recommended range for the test organism, the sensitivity of the organism and/or the credibility of the test system are suspect.

Three reference toxicants are available from EPA Environmental Monitoring Systems Laboratory (EMSL), Cincinnati, OH. An attempt should be made to match the type of toxicant used (e.g., metal or chlorinated organic) to the major pollutant in the wastewater tested.

Chain-of-Custody and Preservation of Documents

Results obtained by persons having expertise in conducting sampling and biomonitoring are valid. Normal EPA chain-of-custody procedures should be used. However, an additional effort in custodial care is required to ensure the admission of biomonitoring information in enforcement proceedings.

For on-site biomonitoring, chain-of-custody records are those that show the source of the materials tested and that indicate that test results are not inaccurate because of deliberate tampering or unintentional error.

For off-site biomonitoring, chain-of-custody consists of records and/or labels, a field data sheet, and/or a field logbook showing where, when, and by whom a sample was taken and the persons to whom custody was relinquished throughout the sampling and testing process. It also includes appropriate notations in the laboratory logbook listing the names of sample custodians, as well as notations on the security measures taken to protect the integrity of the sample during testing.

Data Reporting

The primary purpose of a compliance biomonitoring inspection is to establish permittee compliance status with biomonitoring requirements in a NPDES permit and/or to evaluate the effluent's potential for toxicity to aquatic life in the receiving waters. This is accomplished by comparing the permittee biomonitoring data collection and analysis procedures with the permit conditions. Comparisons could include the following types of data:

- Toxicity of the waste (LC50 or EC50) expressed as a percent dilution
- Instream waste concentration (IWC) of the effluent
- No-Observed-Effect-Level (NOEL)
- Potential for chronic and acute toxicity of waste in the receiving water, including persistence, carcinogenicity, mutagenicity, and teratogenicity
- Permit limits, if contained in the permit, or State Water Quality Standards for toxicity
- Chemical parameters of effluent measured in conjunction with the toxicity test, such as DO, temperature, pH, conductivity, metals, and organics.

The following types of effluent biomonitoring results must be recorded:

- Biological data, including length, weight, and/or age of test organisms and number of test organisms affected.

- Physical and chemical data, including DO, temperature, pH, specific conductivity, total alkalinity, hardness, salinity, and total ammonia nitrogen.

- Reference toxicant data

- Effects measured in each test concentration and control--LC50, EC50, and their 95 percent confidence limits.

- End points for chronic tests that may include the levels of effluent causing significant changes in metabolic rates, survival, growth, production of young, or even behavior. These may be expressed as effective concentrations (EC1, EC50), no effect levels, or maximum allowable toxicant concentrations.

A report of the results of a biomonitoring test must include the elements listed under "Recordkeeping and Data Recording."

Definitions

ACUTE Involves a stimulus severe enough to rapidly induce a response. In toxicity tests, a response observed in 96 hours or less typically is considered acute. An acute effect is not always measured in terms of lethality; it can be expressed as a variety of effects. Note that acute means SHORT, not mortality.

ACUTE-CHRONIC RATION (ACR) Ratio of the acute toxicity (expressed as an LC50) of an effluent or a toxicant to its chronic toxicity (expressed as NOEL). It is used as a factor for estimating chronic toxicity on the basis of acute toxicity data.

ADDITIVITY The characteristic property of a mixture of toxicants that exhibits a cumulative effect equal to the arithmetic sum of its components.

BIOACCUMULATION Uptake and retention of substances by an organism from its surrounding medium and from food.

BIOASSAY A test used to evaluate the relative potency of a chemical by comparing its effect on a living organism with the effect obtained from a standard preparation on the same organism type. Bioassays are frequently used in the pharmaceutical industry to evaluate potency of vitamins and drugs. "Bioassay" and "toxicity test" are not synonymous.

BIOCONCENTRATION Uptake of substances from the surrounding medium through gill membranes or other external body surfaces.

CHRONIC Involves a stimulus that lingers or continues for a relatively long period, often one-tenth of a lifespan or more. Chronic should be considered a relative term depending on the lifespan of an organism. A chronic effect can be lethality, growth, reduce reproduction, etc. Chronic means LONG.

CRITICAL LIFE STAGE The period in an organism's lifespan in which it is the most susceptible to adverse effect caused by exposure to toxicants, usually occurring during early development (egg, embryo, larvae). Chronic toxicity tests are often done at critical life stages to mimic long duration , life cycle tests.

EFFLUENT BIOMONITORING Measurement of biological effects of effluent (e.g., toxicity, biostimulation, and bioaccumulation).

FINAL ACUTE VALUE (FAV) An estimate of the concentration of a chemical that corresponds to the 95th percentile of LC_{50} values obtained for a chemical with different genera of aquatic organisms. The FAV is used for criteria development.

LC50 Toxicant concentration killing 50% of exposed organisms at a specific time of observation.

LOG NORMAL PROBABILISTIC DILUTION MODEL Model that calculates probability distribution of receiving water quality concentrations from log normal probability distributions of the input variables.

NO OBSERVED EFFECT LEVEL (NOEL) Highest measured continuous concentration of an effluent or a toxicant that causes no observed effect on a test organism.

PERSISTENCE Property of a toxicant or an effluent that is a measurement of the duration of its effect. A persistent toxicant or toxicity maintains its effect after mixing, degrading slowly. A nonpersistent toxicant or toxicity may have a quickly reduced effect after mixing as degradation processes such as volatilization and photolysis transform the chemical.

PROBABILITY Number expressing the likelihood of occurrence of a specific event, such as the ratio of the number of outcomes that will produce a given event to the total number of possible outcomes.

SUBLETHAL Involves a stimulus below the level causing death.

SYNERGISM Characteristic property of a mixture of toxicants that exhibits a greater-than-additive cumulative toxic effect.

TOXICITY TEST The means to determine the toxicity of a chemical or an effluent with the use of living organisms. A toxicity test measures the degree of response of an exposed test organism to a specific chemical or effluent.

TOXIC UNIT ACUTE (TU_a) Reciprocal of the effluent dilution that causes the acute effect by the end of the acute exposure period.

TOXIC UNIT CHRONIC (TU_c) Reciprocal of the effluent dilution that causes no unacceptable effect on the test organisms by the end of the chronic exposure period.

WHOLE-EFFLUENT TOXICITY Aggregate toxic effect of an effluent measured directly with a toxicity test.

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Chapter Eight

LABORATORY QUALITY ASSURANCE

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Chapter Eight

A OBJECTIVES AND REQUIREMENTS

The analytical laboratory provides both qualitative and quantitative information for determining the extent of permittee compliance. To be valuable or useful, the data must accurately describe the characteristics and concentrations of constituents in the samples submitted to the laboratory. The objectives of laboratory quality assurance (QA) are to monitor the accuracy and precision of the results reported and to meet reliability requirements.

QA refers to a total program for ensuring the reliability of data by utilizing administrative procedures and policies regarding personnel, resources, and facilities. QA is required for all functions bearing on environmental measurements and includes activities such as: project/study definition; sample collection; laboratory analysis; data validation, analysis, reduction, and reporting; documentation; and data storage systems. Thus, the QA program is designed to evaluate and maintain the desired quality of data. Quality control (QC), a function of QA, is the routine application of procedures for controlling the accuracy and precision of the measurement process and includes the proper calibration of instruments and the use of the appropriate analytical procedures.

Laboratory QA is required by 40 CFR Section 122.41(e), which states that adequate laboratory and process controls, including appropriate QA procedures, must be provided. Each permittee's laboratory should have a QA program. The QA program should be documented in a written QA manual distributed to all personnel responsible for analyses. This manual should identify clearly the individuals involved in the QA program and their responsibilities, and should document the laboratory's standard operating procedures that meet user requirements in terms of specificity, completeness, precision, accuracy, representativeness, and comparability.

Guidance in this chapter is broad based and may not be applicable to every laboratory. A Laboratory Quality Assurance Checklist for the inspector's use is included at the end of this chapter. For detailed information concerning laboratory QA, refer to EPA's Handbook for Analytical Quality Control in Water and Wastewater Laboratories (USEPA 1979a).

B SAMPLE HANDLING PROCEDURES

Evaluation of Permittee Sample Handling Procedures

Proper sample handling procedures are necessary in the laboratory from the sample's receipt until it is discarded. Sample handling procedures for small permittee's may differ from procedures for larger permittee's because staff organizational structures and treatment facility designs vary from one facility to the next. However, proper sample handling procedures should be utilized and documented by all permittee's in order to produce evidence that may be used in an enforcement action. In evaluating laboratory sample handling procedures, the inspector should verify that:

- The laboratory has a sample custodian
- The laboratory area is a secured area and is restricted to authorized personnel only
- The laboratory has a sample security area that is dry, clean, and isolated; has sufficient refrigerated space; and can be locked securely
- Samples are handled by a minimum number of people
- All incoming samples are received by the custodian, who signs the chain-of-custody record sheet accompanying the samples and retains the sheet as a permanent record
- The custodian has ensured that samples are properly stored
- Only the custodian distributes samples to personnel who are to perform analyses
- Care and custody records for handling samples are accurate and up-to-date.

C LABORATORY ANALYSES TECHNIQUES EVALUATION

Evaluation of Permittee Laboratory Analytical Procedures

The methods used by permittee laboratories must be uniform, thus, eliminating methodology as a variable when data are compared or shared among laboratories. Procedures used by the permittee's laboratory must be selected by consulting 40 CFR Part 136 or EPA for approval of alternative methods. Alternative test procedures may be implemented only if the required written EPA approval has been obtained, as specified by 40 CFR Parts 136.4 and 136.5, and promulgated under P.L. 92-500.

Many standardized test procedures that have been promulgated under 40 CFR 136 are covered in Methods for Chemical Analysis of Water and Wastes (USEPA 1979b). Revisions and new additions to this publication are made whenever new analytical techniques or instruments are developed. These are considered accepted after publication in the Federal Register. Other acceptable methods are specified in the latest accepted edition of Standard Methods for the Examination of Water and Wastewater, the Annual Book of Standards, Part 31, Water (APHA, AWWA, and WPCF). (The most current 40 CFR Part 136 may supercede any method or technique cited in this manual.)

In evaluating laboratory analytical procedures, the inspector should verify that:

- Analytical methods specified in 40 CFR Part 136 are followed and any deviations allowed by 40 CFR Part 136 are probably performed
- The QC system used conforms to the system specified in the permit, or detailed in published Standard Methods (APHA, AWWA, and WPCF) or 40 CFR Part 136
- A QC record is maintained on reagent preparation, instrument calibration and maintenance, and purchase of supplies
- QC checks are made on materials, supplies, equipment, instrument calibration and maintenance, facilities, analyses, and standard solutions
- Steps and procedures stated in the method specified in 40 CFR Part 136 are followed
- Documentation of any EPA-approved deviation from specified test procedures is available.

Evaluation of Permittee Laboratory Facilities and Equipment

To verify that the proper analytical procedures are being followed, the inspector should have the responsible analyst describe each of the procedures. The inspector should be alert to any deviation from the specified analytical method. Any questions regarding the proper procedures can be resolved by referring to the cited methodology. Even simple analyses can yield invalid results if the methodology cited in 40 CFR Part 136 is not exactly followed.

Laboratory Services

The availability of laboratory services affects data reliability. The inspector should verify that the following items are provided:

- An adequate supply of laboratory pure water, free from chemical interferences and other undesirable contaminants. Water quality should be checked routinely and documented.
- Adequate bench, instrumentation, storage, and recordkeeping space.
- Adequate humidity and temperature control.
- Adequate lighting and ventilation.
- Dry, uncontaminated, compressed air when required.
- Efficient fume hood systems.
- Necessary equipment such as hot plate, refrigerator for samples, pH meter, thermometer, and balance.
- Electrical power for routine laboratory use and, if appropriate, voltage-regulated sources for delicate electronic instruments.
- Emergency equipment, fire extinguisher, eye wash station, shower, first aid kit, gloves, and goggles.
- Vibration-free area for accurate weighings.

Instruments and Equipment

Instrumentation is extremely important in the analytical laboratory. To a certain extent, analytical instrumentation is always developmental; manufacturers are continually redesigning and upgrading their products, striving for miniaturization, enhanced durability and sensitivity, and improved automation. In evaluating laboratory instruments and equipment, the inspector should verify that:

- Standard and specific procedures for cleaning glassware and containers are followed.
- Written requirements (e.g., instruction manuals) for daily operation of instruments and equipment are provided and followed.
- Standards and appropriate blanks are available to perform standard calibration procedures. Standard concentrations which closely bracket actual sample concentrations should be used.

- Written troubleshooting procedures are available.
- Written schedules for replacement, cleaning, checking, and/or adjustment by service personnel are available and followed.

Maintenance of laboratory facilities and equipment is an important factor in laboratory QA.

Supplies

Chemical reagents, solvents, and gases are available in many grades of purity, ranging from technical grade to various ultrapure grades. The purity of the materials required in analytical chemistry varies with the type of analysis. The parameter being measured and the sensitivity and specificity of the detection system determine the purity of the reagents required. Reagents of lesser purity than that specified by the method should not be used. In evaluating laboratory supplies, the inspector should verify that:

- The required reagent purity for the specific analytical method is used
- Standard reagents and solvents are stored according to the manufacturer's directions
- Working standards are checked frequently to determine changes in concentration or composition
- Concentrations of stock solutions are verified before being used to prepare new working standards
- Laboratory supplies with limited shelf-life are dated upon receipt and shelf-life recommendations, including the discard date on the container and the storage requirements, are observed
- Reagents are prepared and standardized against reliable primary standards
- Standards and reagents are labeled properly.

D QUALITY ASSURANCE AND QUALITY CONTROL

Evaluation of the Precision and Accuracy of the Permittee Laboratory

The purpose of laboratory control procedures is to ensure high-quality analyses by the use of control samples, control charts, reference materials, and instrument calibration. Controls must be initiated and maintained throughout the analysis of samples. Specifically, each testing batch must contain at least one blank, standard duplicate, and spiked (as applicable) sample analysis. When a batch contains more than ten samples, every tenth sample should be followed by a duplicate and a spike (as applicable).

The precision of laboratory findings refers to the reproducibility of estimated replicate observations. In a laboratory QC program, precision is estimated by the analysis of actual samples in duplicate. These may represent a range of concentrations. Accuracy refers to the degree of difference between observed values and known or actual values. The accuracy of a method may be determined by analyses of samples to which known amounts of reference standards have been added (spiked samples).

In evaluating the precision of the measurement process, the inspector should verify that:

- Control samples are introduced into the train of actual samples to monitor the performance of the analytical system.
- Duplicate analyses are performed with each batch of samples to determine precision. In general, ten percent of the sample should be duplicated.
- Precision control charts or other statistical techniques for each analytical procedure are prepared and used. Statistical methods include calculation of mean, standard deviation, and variance to define the range and variability of the data.
- Corrective actions are taken when data fall outside the warning and control limits.
- The out-of-control data or situation and the corrective action taken are fully documented.

In evaluating accuracy, the inspector should verify that:

- Spiked samples are introduced into the train of actual samples at least ten percent of the time to monitor the performance of the analytical system.
- Spiked samples are used to monitor accuracy in each sample batch.
  - The amount of additive is appropriate to the detection limit and sample concentration.
- Accuracy control charts for each analytical procedure are prepared and used.
  - Accuracy limits are established based on standard deviations whose upper and lower control limits are established at three times the standard deviation above and below the central line.
  - The upper and lower warning limits are established at twice the standard deviation above and below the central line. Note: Some parameters have a defined warning limit required by 40 CFR 136.
  - Corrective actions are taken when data fall outside the warning and control limits.
  - The out-of-control data or situation and the corrective action taken are fully documented.

Evaluation of Permittee Data Handling and Reporting

An analytical laboratory must have a system for uniformly recording, processing, and reporting data. In evaluating permittee data handling and reporting, the inspector should verify that:

- Correct formulas are used to calculate the final results.
- Round-off rules are uniformly applied.
- Significant figures are established for each analysis.
- Provisions are available for cross-checking calculations.
- Control chart approaches and statistical calculations have been determined for the purposes of QC and reporting.
- The report forms provide complete data documentation and permanent recording and facilitate data processing.
- The program for data handling provides data in the form/units required for reporting.
- Laboratory records are kept readily available to the regulatory agency for a minimum of 3 years.
- Laboratory notebooks or pre-printed data forms are bound permanently to provide good documentation, including the procedures performed and the details of the analysis, such as the original value recorded, correction factors applied, blanks used, and the reported data values. The notes are dated, indicate who performed the tests, and include any abnormalities that occurred during the testing procedure. The notes are retained as a permanent laboratory record.

Evaluation of Permittee Laboratory Personnel

Analytical operations in the laboratory vary in complexity. Consequently, work assignments in the laboratory should be clearly defined. All analysts should be thoroughly instructed in basic laboratory operations. Those persons performing complex analytical tasks should be qualified and properly trained. All analysts must follow specified laboratory procedures and be skilled in using the laboratory equipment and techniques required for the analyses assigned to them. In evaluating laboratory personnel, the inspector should consider the following factors:

- Adequacy of training
- Skill and diligence in following procedures
- Skill in using equipment and analytical methods
- Precision and accuracy in performing analytical tasks.

Evaluation of Contract Laboratories

When laboratories are contracted to analyze samples, the inspector may need to assure that the laboratory practices at the contracted laboratory are also evaluated. These can also be evaluated by other designated EPA inspectors. If a deficiency is identified at a contracted laboratory, the permittee is responsible for the deficiency and will be notified.

Overview of the Discharge Monitoring Report Quality Assurance Program and How it Relates to the Inspection Program

The validity of the National Pollutant Discharge Elimination System (NPDES) program depends on the quality of the self-monitoring program. The Discharge Monitoring Report Quality Assurance (DMR QA) program is an important tool used to ensure the quality of NPDES self-monitoring data. The program is designed to evaluate and improve the ability of laboratories serving NPDES permittees to analyze and report accurate self-monitoring data.

Major permittees under NPDES are sent performance evaluation samples containing constituents normally found in industrial and municipal wastewaters. They are to analyze these samples using the analytical methods and laboratory normally employed for their reporting of NPDES self-monitoring data. Responding permittees subsequently receive a report showing evaluation of their reported data.

Highlights

- The DMR QA Program has been an excellent means of focusing on and improving the quality of laboratory results used in developing DMR data. Improvements in the DMR QA data have been significant.

- This program has helped major permittees identify and correct both analytical and data handling problems in their laboratories.

- In general, permittees are receptive to the program and recognize its value, including some who challenged EPA's authority to require participation.

- Regions and States are generally supportive and have made good use of the results of this program for targeting inspections and directing other follow-up activities. This ability to concentrate corrective actions on problem permittees results in an increased efficiency in improving the self-monitoring data of all NPDES permittees.

- The program is one of the least resource-intensive methods for maintaining direct and regular technical contact with NPDES permittees. It has been recognized as a cost-effective effort.

- Utilizing computer technology, the following ways of managing and analyzing DMR QA data were started in FY 1985: compiling tracking summaries, comparing performance of the major industries, tracking multiple permittees, and regenerating past performance evaluation reports.

The DMR QA Program and the NPDES inspection programs are interdependent in several areas. First, in targeting the inspections, the DMR QA evaluations of permittee performance can be used, since the evaluations identify potential problems in laboratory analysis or data handling and reporting. This targeting helps direct limited resources to permittees who need them most.

The inspections and DMR QA results are tracked and results are provided to the DMR QA coordinators at EPA Regional Offices and NPDES States. To track follow-up and complete statistical evaluations properly, a code is provided in the Inspection Report Form to indicate when an inspection is the result of a DMR QA evaluation. (This is shown with the Code Q on the inspection form.)

Finally, inspections, particularly the Performance Audit Inspection (PAI), can be used to follow-up the DMR QA. The DMR QA results should be cross-checked with the permit prior to the on-site visit, and parameters that were failed should be stressed during a laboratory inspection.

E REFERENCES AND LABORATORY QUALITY ASSURANCE CHECKLIST

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LABORATORY QUALITY ASSURANCE CHECKLIST

A. GENERAL

Yes No N/A	1. Written laboratory QA manual is available.

B. LABORATORY PROCEDURES

Yes No N/A	1. EPA-approved analytical testing procedures used and on-hand. (written)
Yes No N/A	2. If alternate analytical procedures used, proper approval obtained.
Yes No N/A	3. Calibration and maintenance of instruments and equipment satisfactory.
Yes No N/A	4. QC procedures used.
Yes No N/A	5. QC procedures adequate.
_____	6. Duplicate samples analyzed % of time.
_____	7. Spiked samples used % of time.
Yes No N/A	8. Commercial laboratory used. Name _____ Address _____ Contact _____ Phone _____ Certification # _____

C. LABORATORY FACILITIES AND EQUIPMENT

Yes No N/A	1. Proper grade laboratory pure water available for specific analysis.
Yes No N/A	2. Dry, uncontaminated, compressed air available.
Yes No N/A	3. Fume hood sufficiently ventilated.
Yes No N/A	4. Laboratory sufficiently lighted.
Yes No N/A	5. Adequate electrical sources available.
Yes No N/A	6. Instruments/equipment in good condition.
Yes No N/A	7. Written requirements for daily operation of instruments available.
Yes No N/A	8. Standards and appropriate blanks available to perform daily check procedures.
Yes No N/A	9. Written troubleshooting procedures for instruments available.
Yes No N/A	10. Schedule for required maintenance exists.
Yes No N/A	11. Proper volumetric glassware used.
Yes No N/A	12. Glassware properly cleaned.
Yes No N/A	13. Standard reagents and solvents properly stored.
Yes No N/A	14. Working standards frequently checked.
Yes No N/A	15. Standards discarded after recommended shelf-life has expired.
Yes No N/A	16. Background reagents and solvents run with every series of samples.

LABORATORY QUALITY ASSURANCE CHECKLIST
(Continued)

Yes No N/A	17. Written procedures exist for cleanup, hazard response methods, and applications of correction methods for reagents and solvents.
Yes No N/A	18. Gas cylinders replaced at 100-200 psi.

D. LABORATORY'S PRECISION, ACCURACY, AND CONTROL PROCEDURES

Yes No N/A	1. Multiple replicates (blanks, duplicates, spikes, and splits) analyzed for each type of control check and information recorded.
Yes No N/A	2. Plotted precision and accuracy control methods used to determine whether valid, questionable, or invalid data are being generated from day to day.
Yes No N/A	3. Control samples introduced into the train of actual samples to ensure that valid data are being generated.
Yes No N/A	4. Precision and accuracy of the analyses are good.

E. DATA HANDLING AND REPORTING

Yes No N/A	1. Round-off rules uniformly applied.
Yes No N/A	2. Significant figures established for each analysis.
Yes No N/A	3. Provision for cross-checking calculation used.
Yes No N/A	4. Correct formulas used to calculate final results.
Yes No N/A	5. Control chart approach and statistical calculations for QC and report available and followed.
Yes No N/A	6. Report forms developed to provide complete data documentation and permanent records and to facilitate data processing.
Yes No N/A	7. Data reported in proper form and units.
Yes No N/A	8. Laboratory records readily available to regulatory agency for required time 3 years.
Yes No N/A	9. Laboratory notebook or pre-printed data forms bound permanently to provide good documentation.
Yes No N/A	10. Efficient filing system exists, enabling prompt channeling of report copies.

F. LABORATORY PERSONNEL

Yes No N/A	1. Enough analysts present to perform the analyses necessary.
Yes No N/A	2. Analysts have on-hand the necessary references for EPA procedures being used.
Yes No N/A	3. Analysts trained in procedures performed through formal or informal training or certification programs.

Chapter Nine

PRETREATMENT

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Chapter Nine

A REVIEW OF THE GENERAL PRETREATMENT REGULATIONS

Development of 40 CFR Part 403

The Clean Water Act (CWA) requires EPA to promulgate regulations to control the discharge of pollutants to the Nation's waters in order to preserve their physical, chemical, and biological integrity. The National Pollutant Discharge Elimination System (NPDES) program is the primary regulatory mechanism developed to control point-source discharges to the surface waters of the United States. The National Pretreatment Program is the mechanism developed to regulate industries that discharge pollutants to publicly owned treatment works (POTWs), which in turn are regulated under the NPDES program.

The General Pretreatment Regulations (40 CFR Part 403) were promulgated on June 26, 1978. Amendments to the regulations were promulgated on January 28, 1981. These regulations establish the basic pretreatment procedures, responsibilities, and requirements for EPA, States, POTWs, and industries. The definition for new source was promulgated July 10, 1984. Definitions for interference and pass through were promulgated on January 14, 1987. On June 12, 1986, EPA proposed additional changes to Part 403 in response to recommendations made by the Pretreatment Implementation Review Task Force (PIRT). At the time of publication of this document, these amendments are being finalized. A summary of the General Pretreatment Regulations is provided in Table 9-1. Major technical changes resulting from final regulatory amendments or court decisions are noted in this table.

The purpose of the General Pretreatment Regulations is to protect POTWs and the environment from the damage that may result from discharges of pollutants to sanitary sewer systems. The three specific objectives cited in Part 403.2 of the General Pretreatment Regulations are to:

- Prevent the introduction of pollutants that would cause interference with the POTW or limit the use and disposal of its sludge
- Prevent the introduction of pollutants that would pass through the treatment works or be otherwise incompatible
- Improve the opportunities to recycle or reclaim municipal and industrial wastewaters and sludges.

In addition, improved POTW worker health and safety and reduction of influent loadings to sewage treatment plants are further objectives of pretreatment. Briefly stated, the definitions for interference and pass through are the following (see 40 CFR 403.3 for the exact definitions).

- Interference is a discharge that alone or in conjunction with other discharges, disrupts the POTW or sludge processes, and therefore in turn causes violation of any requirement of the POTW's NPDES permit or prevents the POTW from using its chosen sludge use or disposal practice.

- Pass through is a discharge that exits the POTWs to waters of the United States in quantities or concentrations which, alone or in conjunction with other discharges, causes a POTW NPDES permit violation.

The General Pretreatment Regulations detail the procedures, responsibilities, and requirements of EPA, States, POTWs, and industries. To achieve the objectives of the regulations, implementation of the program by all regulated entities must be accomplished. In the next three sections, the specific responsibilities of each are explained.

Guidance manuals developed to assist EPA Regional Offices, States, POTWs, and industries with implementation of the General Pretreatment Program are listed in Section C, "References," of this chapter. In addition, policy memorandums from the EPA Office of Water Enforcement and Permits on pretreatment issues are listed.

Approval Authority Responsibilities

Two terms are important in understanding the General Pretreatment Regulations: "Control Authority" and "Approval Authority." Control Authority directly regulates the significant industrial users discharging to a POTW; Approval Authority oversees the development and implementation of POTW pretreatment programs and, for POTWs without an approved pretreatment program, is also the Control Authority that regulates industrial discharges to the POTW. The EPA Regional Office is the Approval Authority until a State is delegated the authority to administer the pretreatment program.

A pretreatment program is administered through the EPA Regional Office or a State with NPDES and pretreatment delegation. The principal tasks for which an Approval Authority (EPA Regional Office or delegated State) is responsible are:

- Review and approval of POTW pretreatment programs.

- Oversight of POTW program implementation: Pretreatment Compliance Inspections (PCIs), audits, and annual report reviews.

- Providing technical assistance to POTWs in implementation of the requirements of the General Pretreatment Regulations, categorical pretreatment standards, and POTW pretreatment program requirements.

- Notifying POTWs of program requirements.

- Applying and enforcing pretreatment standards at industries discharging to POTWs that do not have an approved local pretreatment program (see "POTW Responsibilities" for what POTW program development entails).

- Initiating enforcement action against noncompliant POTWs or industries.

Part 403.10 of the General Pretreatment Regulations identifies the requirements a State must meet to receive delegation of the pretreatment program as part of its NPDES authority, that is, to become an Approval Authority. All States having or seeking NPDES authority must apply for pretreatment program delegation. Part 403.10(f) lists the requirements to be addressed in a State pretreatment program submission. In summary, the State is required to develop and document the following:

- Legal authority. A statement from the Attorney General that certifies that the State has enabling statutes and regulations that provide adequate authority to allow the operation and enforcement of the pretreatment program as specified by the General Pretreatment Regulations

- Procedures. Procedures to implement and enforce the pretreatment program and Sections 307(b) and (c), and 402(b)(1), (2), (8), and (9) of the Act

- Resources. The State must ensure adequate funding, equipment, and personnel for implementing the program as described in the procedural section of the submission.

For States preferring to assume the responsibility of directly regulating industries discharging to POTWs and, hence, being considered the Control Authority in lieu of POTWs within the State, Part 403.10(e) provides that option. The State then must develop as part of the program additional procedures that detail how it will implement the Control Authority responsibilities. This document is submitted to EPA for approval, and upon receipt of approval, the State will become responsible for the principal Approval Authority implementation tasks specified above and Control Authority responsibilities for <u>all</u> indirect industrial dischargers, if the State has developed the additional procedures for regulating the appropriate industries without POTW pretreatment programs.

POTW Responsibilities

POTW pretreatment program development and implementation requirements must be included in the NPDES permit of POTWs required to develop programs. Those requirements will thereby become an enforceable component of the permit. Part 403.8 of the General Pretreatment Regulations details the responsibilities of a POTW during the development of a pretreatment program. In summary, the POTW must address the following four tasks:

- Legal authority. The POTW must develop the legal authorities that will enable it to apply and enforce the General Pretreatment Regulations and local sewer use regulations.

- Technical evaluation.

  - Identification of all industrial users that may discharge wastes of a volume, concentration, or nature of concern to the POTW (significant industrial users), including all categorical industries
  - Determine sampling and analysis needs
  - Determine the character and volume of pollutants discharged to the POTW
  - Identify pollutants that may interfere or pass through the treatment plant or cause sludge contamination
  - Determine the maximum allowable pollutant loading to the treatment plant for all pollutants of concern
  - Develop specific limitations for pollutants of concern where needed to prevent pass through, interference, and sludge contamination.

- Procedures. The POTW must develop administrative procedures to implement the program including:

  - Collecting industrial discharge data through industrial self-monitoring reports and/or POTW monitoring
  - Evaluating industrial user compliance
  - Notifying users of pretreatment requirements and other appropriate regulations
  - Updating the industrial user survey
  - Administering a permit system or other means to convey pretreatment standards and requirements
  - Initiating appropriate enforcement action.

- Administrative organization. The POTW must provide sufficient resources (funds, personnel, and equipment) to operate an effective program and must maintain and manage the data collected during program development and implementation.

Additional information on the responsibilities of POTWs is provided in the EPA Guidance Manual for POTW Pretreatment Program Development.

The POTW program is submitted to the Approval Authority, either the EPA Regional Office or the delegated State. Once approval has been received, the NPDES permit is amended to require the POTW to implement the program. As of December 31, 1987, 1,464 POTWs have been required to develop programs; 1,410 of these programs have been approved.

Before a POTW pretreatment program is approved, the Approval Authority is the Control Authority for industries discharging to the POTW. After program approval, the POTW becomes responsible for implementing the requirements specified in the General Pretreatment Regulations [40 CFR Part 403.8(f)], the POTW pretreatment program, as well as the requirements of the NPDES permit (the permit must be complied with regardless of program approval). To fully implement the pretreatment program throughout the entire service area, the POTW must do the following:

- o Legal authority
  - Implement and enforce an adequate sewer use ordinance
  - Implement the industrial user control mechanism (e.g., industrial user permit program)
  - Maintain current agreements or contracts with other political jurisdictions that discharge to the POTW.
- o Pretreatment standards
  - Identify the character and volume of pollutants contributed to the POTW
  - Reevaluate local limits periodically to ensure protection of the POTW from interference or pass through and to ensure the use or disposal of POTW sludge
  - Notify all industrial users of appropriate pretreatment standards, any changes to the regulations, and Resource Conservation and Recovery Act (RCRA) requirements
  - Apply appropriate pretreatment standards to all significant industrial users (i.e., categorical pretreatment standards or local limits whichever are more stringent)
  - Update the industrial survey to identify new industries that should be regulated by the POTW pretreatment program, and identify changes in manufacturing processes and wastewater discharge characteristics at existing facilities
  - Comply with public participation requirements.
- o Industrial user compliance and enforcement
  - Establish reporting, inspection, and monitoring requirements and procedures to enable evaluation of compliance
  - Develop an enforcement management strategy to guide compliance evaluation and enforcement activities
  - Evaluate industry compliance by reviewing and analyzing of self-monitoring reports and POTW monitoring
  - Identify noncompliant industries
  - Initiate appropriate enforcement action to bring users into compliance
  - Establish other procedures as required and/or determined to be needed to regulate the significant industries discharging to the POTW.

- Public participation

  - Publish a list, in the local newspaper with the greatest circulation, of the industrial users that were in significant violation within the past 12 months as defined in 40 CFR Part 403.8(f)
  - Notify the public of any changes to the sewer use ordinance or local limits after approval by the Approval Authority
  - Submit pretreatment program modifications to Approval Authority.

- Data management

  - Maintain records of pertinent industrial user activities and compliance status
  - Maintain a current understanding of the categorical pretreatment standards and General Pretreatment Regulations and notify industries of any changes
  - Provide the Approval Authorities with any reports required.

- Resources

  - Provide adequate resources for implementation.

As pretreatment needs change, the POTW may need to revise the approved program. When this occurs, the POTW should submit the modifications to the Approval Authority for review and approval.

Industry Responsibilities

Industrial dischargers to POTWs must comply with the following:

- Prohibited discharge standards: The general and specific prohibited discharge standards (40 CFR Part 403.5) are noted in Table 9-1.
- Appropriate pretreatment standards: Categorical pretreatment standards, State requirements, or locally developed discharge limitations.
- Reporting requirements: As specified in Part 403.12 and/or by the POTW. The requirements provided in Part 403.12 are summarized in Table 9-1.

The types of industrial facilities that are categorical industries are listed in Table 9-2. EPA has developed categorical pretreatment standards for these industries based on the characteristic wastes produced by the manufacturing processes at each type of industry, the wastewater control technologies available to the industry, and economic considerations. The categorical pretreatment standards developed apply to the wastewaters from specific manufacturing processes. The standards apply at the point of discharge from the pretreatment unit for the regulated process, or if there is no pretreatment unit, they apply at the point of discharge of the process wastewater.

Where the POTW has determined that specific limitations for certain pollutants of concern are needed to protect the POTW from interference, pass through and sludge contamination, the POTW must develop and enforce such limitations. These local limitations generally are applied at the point the industrial facility discharges to the POTW.

An industry must meet the more stringent pretreatment standard for each pollutant. For a categorical industry, this will be the categorical pretreatment standard or a local limit for each pollutant regulated. If the point at which the POTW's limitation applies is not the same as the point at which the categorical pretreatment standard applies, then a calculation to adjust the categorical pretreatment standard may have to be used to compare the discharge limitations.

When evaluating the pretreatment standards to determine the appropriate limitation, note that different categorical pretreatment standards were developed for each type of industry. If the industry combines the flows from more than one regulated process or combines a regulated process flow with other flows before these wastes are treated, the Control Authority and the industry must adjust the categorical pretreatment standard using the Combined Wastestream Formula (CWF). The equation is provided in Part 403.6(e) of the General Pretreatment Regulations. If the wastewaters are mixed after treatment, the categorical pretreatment standards must still be adjusted, in this case by flow weighted averaging of all flows introduced prior to the sample point. Additional information on the combined wastestream formula and the flow weighted averaging formula is provided in the EPA Guidance Manual for Implementing Production - Based Pretreatment Standards and the Combined Wastestream Formula (US EPA 1985).

Table 9-2 summarizes the important milestone dates for categorical industries: the publication dates of the proposed and final regulations, the effective and compliance dates, and the due dates for reports specified in the General Pretreatment Regulations. The appropriate regulation should be referenced to determine the applicable categorical pretreatment standards.

Categorical industries have specific reporting requirements as per Part 403.12. A summary of the reports that categorical industries are required to submit is provided in Table 9-1. A POTW may require additional reports from all industries discharging to the system, including categorical industries.

Table 9-1

Summary of the General Pretreatment Regulations

403.1 Purpose and Applicability

403.2 Objectives of General Pretreatment Regulations

403.3 Definitions

403.4 State or Local Law

The Federal General Pretreatment Regulations are not meant to affect any state or local regulatory requirements as long as these requirements are at least as stringent as the Federal regulations.

403.5 National Pretreatment Standards: Prohibited Discharges

This section specifies general and specific prohibited discharge standards that POTWs must incorporate into their local limits. The general prohibitions specify that pollutants introduced into POTWs by a nondomestic source shall not pass through the POTW or interfere with the operation or performance of the works. The section provides that POTWs that are required to develop local pretreatment programs (and POTWs where interference and pass through are likely to re-occur) develop and enforce specific limitations (local limits) to implement the general prohibitions against interference, pass through and sludge contamination.

The specific prohibitions specify prevention of discharge of pollutants that cause any of the following at the POTW:

- Fire or explosion hazard
- Corrosive structural damage - no pH<5.0
- Obstruction to the flow in the POTW
- Interference
- Heat causing inhibition of biological activity and temperatures at the POTW treatment plant to exceed 40°C (104°F)

Table 9-1

Summary of the General Pretreatment Regulations (Continued)

403.6	National Pretreatment Standards: Categorical Standards This section discusses development and implementation of Categorical Pretreatment Standards including, but not limited to, compliance deadlines, prohibition of dilution as a substitute treatment, and the combined wastestream formula (CWF) to determine discharge limitations.
403.7	Revision of Categorical Pretreatment Standards to Reflect POTW Removal of Pollutants This section (referred to as the removal credits provision) provides the criteria and procedures to be used by a POTW in revising the pollutant discharge limits specified in Categorical Pretreatment Standards to reflect removal of pollutants by the POTW. (No removal credits may be granted until the final sludge regulations are promulgated.)
403.8	POTW Pretreatment Programs: Development by POTW This section covers the requirements for pretreatment program development by a POTW. Included in this section are criteria for determining which POTWs must develop pretreatment programs, incorporation of approved programs and compliance schedules into NPDES permits, deadlines for program approvals, and program funding requirements. The section requires the POTW to have legal authority to enforce the approved pretreatment program. The section also discusses that all POTWs with approved programs, or programs under development, must develop and implement procedures to ensure compliance with the requirements of a pretreatment program.
403.9	POTW Pretreatment Programs and/or Authorization to Revise Pretreatment Standards: Submission for Approval This section discusses requirements and procedures for submission and review of POTW pretreatment programs. Included in this section are discussions of conditional program approval, approval authority action, and notification where submissions are defective.

Table 9-1

Summary of the General Pretreatment Regulations (Continued)

403.10 Development and Submission of NPDES State Pretreatment Programs

This section discusses requirements and procedures for submission and review of NPDES state pretreatment programs. Included in this section are discussions of approvals and deadlines for state programs, program and funding requirements, and contents of program submissions.

403.11 Approval Procedures for POTW Pretreatment Programs and POTW Revision of Categorical Pretreatment Standards

This section provides the administrative procedures for the review and approval or denial of POTW pretreatment program submissions and requests for removal credit authority.

403.12 Reporting Requirements for POTWs and Industrial Users

This section presents reporting requirements for POTWs and industrial users. Reports required by industrial users include the following:

- Baseline monitoring report (BMR). Due to the Control Authority within 180 days of the effective date of the categorical pretreatment standards (40 CFR Part 403.6). In addition, new source BMR reporting requirements are discussed in this section.
- Compliance schedule progress reports. Due to the Control Authority within 14 days of completion of compliance schedule milestones or due dates.
- 90-day compliance report. Due to the Control Authority within 90 days of the compliance date of the categorical standards.
- Periodic compliance reports. Due to the Control Authority at least semi-annually, usually in June and December after the compliance date.
- Notices of slug loadings. Due to the POTW immediately upon identification of the slug discharge for both noncategorical industries as well as categorical.

Table 9-1

Summary of the General Pretreatment Regulations (Continued)

403.12 (Continued)

Reports required from POTWs include the following:

- Compliance schedule (for development of pretreatment programs) progress reports
- Removal credit reports.

Also discussed in detail in this section are monitoring requirements for industrial users and signatory and recordkeeping requirements for POTWs and industrial users.

403.13 Variances from Categorical Pretreatment Standards for Fundamentally Different Factors

This provision allows an industrial user, or any interested person, to request a variance for the establishment of limits either more or less stringent than that required by a Categorical Pretreatment Standard. The primary criterion required for approval of this variance is that the factors relating to the industrial user's discharges are fundamentally different from factors considered by EPA in establishing Categorical Pretreatment Standards for these discharges.

403.14 Confidentiality

This section covers confidentiality requirements and prohibitions for EPA, states, and POTWs. Effluent data is available to the public without restriction.

403.15 Net/Gross Calculation

This provision provides for adjustment of Categorical Pretreatment Standards to reflect the presence of pollutants in the industrial user's intake water.

403.16 Upset Provision

This provision is consistent with the NPDES regulations and allows an upset of an industry's pretreatment system (which meets the conditions of an upset as specified in this provision) to be an affirmative defense to an action brought for noncompliance with Categorical Pretreatment Standards. The industrial user shall have the burden of proof for such a defense.

Table 9-1

Summary of the General Pretreatment Regulations (Continued)

Appendix A Program Guidance Memorandum

This memorandum summarizes the Agency's policy on the use of construction grants for treatment and control of combined sewer overflows and stormwater discharges.

Appendix B 65 Toxic Pollutants

This appendix lists the 65 classes of toxic pollutants that are regulated by the pretreatment program through Categorical Pretreatment Standards

Appendix C 34 Industrial Categories (Amended and retitled as "Industrial Categories Subject to National Categorical Pretreatment Standards")

This appendix lists industrial categories (except those that are exempted by paragraph 8 of the NRDC V. EPA Consent Decree) that are under consideration to be regulated by Categorical Pretreatment Standards. Standards have been promulgated or proposed for 24 categories.

Appendix D Selected Industrial Subcategories Exempted from Regulation Pursuant to Paragraph 8 of the NRDC v. Costle Consent Decree (Amended and retitled as "Selected Industrial Subcategories Considered Dilute for Purposes of the Combined Wastestream Formula")

Appendix D is to be used only for the purpose of applying the combined wastestream formula. Wastestreams for the subcategories listed in the appendix are "dilute" wastestreams as per the definition in the formula.

Table 9-2

Summary Status of National Categorical Pretreatment Standards: Milestone Dates

Industry Category	40 CFR Part	Proposed/ New Source Rule Date(2)	Final Rule Date	Effective Date	BMR Due Date	PSES Compliance Date	90-day Compliance Report Due Date
		Final Regulations(1)					
Aluminum Forming	467	11-22-82	10-24-83	12-07-83	6-04-84	10-24-86	1-22-87
Battery Manufacturing	461	11-10-82	3-09-84	4-23-84	10-20-84	3-09-87	6-07-87
Coil Coating I	465	1-12-81	12-01-82	1-17-83	7-16-83	12-01-85	3-01-86
Coil Coating (Canmaking)	465	2-10-83	11-17-83	1-02-84	6-30-84	11-17-86	2-15-87
Copper Forming	468	11-12-82	8-15-83	9-26-83	3-25-84	8-15-86	11-13-86
Electrical & Electronic Components I	469	8-24-82	4-08-83	5-19-83	11-15-83	7-01-84 (TTO)(3) 11-08-85 (As)	9-29-84 2-06-86
Electrical & Electronic Components II	469	3-09-83	12-14-83	1-27-84	7-15-84	7-14-86	10-12-86
Electroplating	413	7-30-80(4)	1-28-81	3-30-81	9-26-81 (Non-int.) 6-25-83 (Int.)	4-27-84 (Non-Int.) 6-30-84 (Int.)	7-26-84 9-28-84
		---	7-15-83	8-29-83	2-25-84 (TTO)	7-15-86 (TTO)	10-13-86
Inorganic Chemicals Interim, I & II	415	--- 7-24-80 10-25-83	7-20-77 6-29-82 8-22-84	7-20-77 8-12-82 10-05-84	1-16-78 5-09-83 4-03-85	See Footnote(5)	10-18-80 9-27-85 11-20-87
Iron & Steel	420	1-07-81	5-27-82	7-10-82	4-06-83	7-10-85	10-08-85
Leather Tanning & Finishing	425	7-02-79	11-23-82	1-06-83	7-05-83	11-25-85	2-23-86

Table 9-2

Summary Status of National Categorical Pretreatment Standards: Milestone Dates (Continued)

Final Regulations							
Industry Category	40 CFR Part	Proposed/ New Source Rule Date(2)	Final Rule Date	Effective Date	BMR Due Date	PSES Compliance Date	90-day Compliance Report Due Date
Metal Finishing	433	8-31-82(4)	7-15-83	8-29-83	2-25-84	6-30-84 (Part 433, TTO)(6)	9-28-84
						7-10-85 (Part 420, TTO)	10-08-85
						2-15-86 (Final)	5-16-86
Metal Molding and Casting (Foundries)	464	11-15-82	10-30-85	12-13-85	6-11-86	10-31-88	1-29-89
Nonferrous Metals Forming	471	3-05-84	8-23-85	10-07-85	4-05-86	8-23-88	11-21-88
Nonferrous Metals I	421	2-17-83	3-08-84	4-23-84	10-20-84	3-09-87	6-07-87
Nonferrous Metals II	421	6-27-84	9-20-85	11-04-85	5-03-86	9-20-88	12-19-88
Organic Chemicals, Plastics and Synthetic Fibers (OCPSF)	414 416	3-21-83	11-05-87	12-21-87	6-20-88	11-05-90	2-03-91
Pesticide Chemicals	455	11-30-82	10-04-85 (Remanded 7/86. Removed 12/86. See footnote (7))				
Petroleum Refining	419	12-21-79	10-18-82	12-01-82	5-30-83	12-01-85	3-01-85
Pharmaceuticals Manufacturing	439	11-26-82	10-27-83	12-12-83	6-09-84	10-27-86	1-25-87
Porcelain Enameling	466	2-27-81	11-24-82	1-07-83	7-06-83	11-25-85	2-23-86

Table 9-2

Summary Status of National Categorical Pretreatment Standards: Milestone Dates (Continued)

Final Regulations							
Industry Category	40 CFR Part	Proposed/ New Source Rule Date(2)	Final Rule Date	Effective Date	BMR Due Date	PSES Compliance Date	90-day Compliance Report Due Date
Pulp, Paper, Paperboard	430 431	1-06-81	11-18-82	1-03-83	7-02-83	7-01-84	9-29-84
Steam Electric Power Generation	423	10-14-80	11-19-82	1-02-83	7-01-83	7-01-84	9-29-84
Timber Products Processing	429	10-31-79	1-26-81	3-30-81	9-26-81	1-26-84	4-25-84

Table 9-2

Summary Status of National Categorical Pretreatment Standards: Milestone Dates (Continued)

Footnotes:

(1) The dates identified below are for all categorical standards that have been finalized. Other categories, or modifications to existing categories may be proposed in the future. These changes will be incorporated in future editions of this manual.

(2) The date of the proposed rule is used to determine sources regulated by categorical pretreatment standards for new sources. Industrial facilities that were in existence, or began construction of the regulated processes before that date, are considered existing sources and are regulated by categorical Pretreatment Standards for Existing Sources (PSES). New sources are facilities that began construction of the regulated processes after the date of the proposed rule. The compliance date for any new source (PSNS) is the same date as the commencement of the discharge.

(3) The compliance date for existing phase I electrical and electronic components manufacturers for total toxic organics (TTO) is July 1, 1984. The compliance date for arsenic is November 8, 1985.

(4) The electroplating proposed rule date is not used to determine new source/existing source. The metal finishing proposed rule date is used for all electroplating and metal finishing facilities.

(5) The compliance date for Subparts A, B, L, AL, AR, BA, and BC is July 20, 1980. The compliance date for Subparts AJ, AU, BL, BM, BN, and BO (except discharges from copper sulfate or nickel sulfate processes) is August 22, 1987. The compliance date for copper sulfate or nickel sulfate processes and for all Subparts of Part 415 not listed above is June 29, 1985. Reference: Part 415.01, Compliance Dates for Pretreatment Standards for Existing Sources, Federal Register, Vol. 49, page 43420, August 22, 1984.

(6) Existing sources that are subject to the metal finishing standard in 40 CFR Part 433 must comply only with the interim limit for TTO by June 30, 1984, except for facilities that are also subject to the iron and steel manufacturing standards in 40 CFR Part 420, which must comply with the interim TTO limit by July 10, 1985. The compliance date for metals, cyanide, and final TTO is February 15, 1986, for all sources.

(7) On July 25, 1986 the Eleventh Circuit Court of Appeals remanded to EPA the final regulation for the Pesticide Chemicals Category Effluent Limitations Guidelines, Pretreatment Standards, and New Source Performance Standards. EPA removed the regulation from the Code of Federal Regulations on December 15, 1986 (51 FR 44911).

B PRETREATMENT COMPLIANCE INSPECTIONS (PCIs) AND AUDITS

Scope of PCIs and Audits

The Pretreatment Compliance Inspection (PCI) and audit have been developed as oversight mechanisms for Approval Authorities. They provide an opportunity for EPA and State officials to conduct an on-site review of a POTW pretreatment program.

The PCI has been designed to be incorporated into the existing NPDES inspection program. The focus is to evaluate POTW compliance monitoring and enforcement activities. The PCI also is designed to determine if any changes have been made to the POTW program since the last PCI, audit, annual report, or POTW program modification request approval. The role of a NPDES inspector during a PCI is as a data gatherer to collect information on POTW program implementation for further evaluation by Water Enforcement and Permits personnel.

The PCI should be conducted in conjunction with other NPDES inspections to conserve travel resources and allow integration of information on the many facets of a POTW's operations. PCIs are compatible with Compliance Evaluation Inspections (CEIs), Compliance Sampling Inspections (CSIs), Performance Audit Inspections (PAIs), Diagnostic Inspections (DIs), and other nonroutine inspections, such as Toxics Sampling Inspections, and Compliance Biomonitoring Inspections.

It should be noted that the POTW personnel involved in a CSI may be different from the ones involved in a PCI. Also PCIs and audits rely heavily on file and record reviews to evaluate the POTW's pretreatment program implementation efforts. These records may have little bearing on a technical inspection of the treatment facility. This aspect of a PCI should be addressed when planning for the inspection.

Audits have been designed as a comprehensive review of all facets of the POTW pretreatment program. The audit addresses all of the items covered in a PCI, sometimes in more detail, as well as seeks additional information about other implementation tasks, such as: legal authority, application of pretreatment standards, data management, and program resources. The audit is more resource intensive than the PCI.

A May 13, 1986, memorandum from James Elder, Director, Office of Water Enforcement and Permits, stated the strategy for conducting PCIs and audits. Audits would be conducted every fifth year, preferably during the year of NPDES permit reissuance so that any additional requirements for program implementation could be incorporated in the reissued permit. PCIs would be conducted during intervening years.

Procedures for conducting PCIs and audits are similar. In general, there are three major components:

- Pre-visit preparation for the PCI or audit

  - Coordination with the EPA Regional or State Pretreatment Coordinator
  - Review of background information: approved program, POTW annual reports (if available), NPDES permit compliance status, POTW fact sheet, and program modification requests from the POTW
  - Notification of POTW officials (if appropriate).

- On-site

  - Opening conference with POTW officials
  - Interview of officials using PCI or audit checklist
  - Review of POTW pretreatment files
  - Industrial inspections (optional)
  - Tour of POTW (optional)
  - Closing conference.

- Follow-up

  - Preparation of report
  - Data entry into PCS
  - Follow-up letter to the POTW
  - Enforcement action (when necessary)
  - NPDES permit or program modifications (when necessary).

If a PCI is conducted with an unannounced NPDES inspection, it also may be unannounced, but the POTW officials should be notified of the PCI upon arrival of the inspection team. At many POTWs, personnel responsible for implementing the program may not be the same as those operating the treatment plant.

The protocol involved in the on-site portion of the inspection is comparable to that of other NPDES inspections. One aspect of a POTW PCI or audit that differs from other NPDES compliance inspections is inclusion of a tour of industrial facilities discharging to the POTW. This aspect may be included as an optional component of both PCIs and audits to evaluate the POTW's procedures for monitoring and inspecting industries. For more detailed information on conducting PCIs and audits, a guidance manual has been developed by the Office of Water Enforcement and Permits: Pretreatment Compliance Inspection and Audit Manual for Approval Authorities (USEPA 1986b).

A detailed checklist intended for use during a PCI is provided in the PCI and audit guidance manual. The organization and focus of the detailed checklist are discussed in the following section.

PCI Checklist Components

The PCI checklist was developed to assist NPDES inspectors in conducting and documenting the PCI. The checklist is organized into four sections:

- Control Authority Background Information
- Compliance Monitoring and Enforcement--POTW Personnel Response
- Compliance Monitoring and Enforcement--POTW File Evaluation
- Summary Evaluation of POTW Pretreatment Program.

The first section should be completed before the on-site visit from a file review and/or a POTW program fact sheet that has been developed. This information should be verified during the POTW personnel interview. The second and third sections are conducted on-site, one as an interview with the POTW personnel and the other from information collected during a review of the POTW's files on industrial users. The final section is completed after the on-site portion of the PCI as an evaluation of the information collected.

In more detail, the four sections address the following information:

Section I: Control Authority Background Information

This section summarizes information about the Control Authority, including NPDES permit number, previous PCIs or audits, annual reports, and current POTW official responsible for the pretreatment program. The importance of reviewing previous PCIs or audit reports and discussing the POTW program with the Regional and/or State Pretreatment Coordinator and compliance personnel cannot be overemphasized. This preparation can help focus the PCI inspector on the problems of the POTW pretreatment program and increase the effectiveness of the program.

Section II: Compliance Monitoring and Enforcement--Control Authority Personnel Response

This section is divided into six parts, each addressing a different aspect of the POTW's application of pretreatment standards, compliance evaluation, and enforcement activity. The information is collected by interviewing the appropriate POTW personnel. The following topics should be discussed:

- Control Authority Pretreatment Program Overview. This section requests details about the POTW program: number of industries regulated, definition of significant industrial users, percentage of industrial flow to the POTW, and history of problems at the POTW.

- Control Authority Pretreatment Program Modifications. This section documents any changes to the program since the last PCI or audit, annual report, or POTW program modification request.

- Control Authority Inspection and Monitoring of Industrial Users. This section documents the POTW's efforts over the past year in monitoring and inspecting the regulated industrial users. Questions are focused on comparing the present effort with the level specified in the approved POTW program or recommended in EPA guidance documents such as the Pretreatment Compliance Monitoring and Enforcement Guidance Manual (USEPA 1986c). The type of information collected by the POTW during industrial inspections or from industrial self-monitoring reports also is reviewed. The inspector should also review and attempt to evaluate the POTW's procedures for monitoring and inspecting industrial facilities.

- Control Mechanism Evaluation. This section documents the status of control mechanism issuance (i.e., industrial user permits), in particular the existence of industries that are unregulated or are operating with an expired control mechanism.

- Enforcement Procedures. This section evaluates the Control Authority procedures for reviewing industrial user self-monitoring reports and POTW compliance monitoring data, for evaluating compliance, and for initiating enforcement action.

- Compliance Tracking. This section determines if the POTW has developed a tracking system to document regularly the compliance status of the industrial users.

Section III: Compliance Monitoring and Enforcement--Industrial User File Evaluation

The PCI reviews the POTW's files as a means of verifying information collected during the interview. In general, the file is reviewed to determine if specific items, such as permit applications, permits, industrial inspection reports correspondence, and monitoring data are retained by the POTW.

The checklist has space for comments on five industrial files; however, more may be reviewed. The files reviewed during the PCI should be representative of the industries regulated by the POTW. Files for categorical and noncategorical industries and most importantly the files of industries with compliance problems should be reviewed.

Section IV: Summary Evaluation of Control Authority Pretreatment Program

The summary evaluation provides a mechanism for the inspector to document the findings of the PCI. This section addresses each of the following program components individually: Control Authority Monitoring and Inspection, Industrial User Self-Monitoring, Control Mechanism Issuance, and Control Authority Enforcement. It also provides an opportunity to note other findings and follow-up actions that may be necessary. The inspector should be cautious and not make judgments concerning program implementation on-site.

Information in the evaluation section can be used as part of the follow-up response to the POTW. However, before any evaluation of the POTW program is transmitted to the POTW, the evaluation should be reviewed by Approval Authority personnel who are fully aware of the pretreatment program requirements. In some situations when more formal enforcement action may be contemplated as a result of the PCI findings, the Approval Authority may choose not to send the summary evaluation to the POTW.

In addition to the completed checklist, other materials collected during the PCI may be included in the final report as appendices. These items may include:

- Example of POTW enforcement actions
- Description of significant changes to the POTW program
- Names of industries that were not sampled or inspected in the past year
- Names of significant industrial users that are not in compliance
- POTW enforcement procedures
- Annual list of industrial users with significant violations.

The PCI checklist can be found in the Pretreatment Compliance Inspection and Audit Manual for Approval Authorities (USEPA 1986b). The manual goes through each checklist section individually and explains the intent of the questions. As noted earlier, the manual provides more detailed information concerning the procedures for conducting the PCI.

Summary of Audit Checklist Components

The audit checklist has been developed to assist with a detailed review of a POTW pretreatment program. The checklist is more detailed than the one used for PCIs, since a greater number of POTW pretreatment program components are reviewed. The audit checklist is divided into the following ten sections, each of which focuses on a specific program component:

I. Control Authority Background Information
II. POTW Program Fact Sheet
III. Legal Authority and Control Mechanism
IV. Application of Pretreatment Standards
V. Compliance Monitoring
VI. Enforcement
VII. Data Management and Public Participation
VIII. Program Resources
IX. POTW File Review
X. Evaluation and Summary

As with the PCI, the audit is conducted in three stages. The checklist has been developed to correspond to these stages: pre-visit preparation (Sections I-II), POTW interview and file review (Sections III-IX), and evaluation (Section X). The sections of the audit checklist have been developed to collect more detailed information than the PCI checklist and, as with the completed PCI checklist, also may be augmented by additional audit data such as:

- NPDES pretreatment permit conditions
- POTW enforcement documents with pretreatment requirements (i.e., administrative order, consent decree)
- Locally developed discharge limitations as included in the approved program (or any limits that have been changed by the POTW)
- Copy of sewer use ordinance if different than in the approved program
- POTW sampling and inspection schedule for regulated industries
- List of industries not sampled or inspected in the past year
- POTW chain-of-custody form
- List of noncompliant industries and history of enforcement actions taken.

The audit checklist is incorporated as part of the Pretreatment Compliance Inspection and Audit Manual for Approval Authorities (USEPA 1986b). The manual provides specific guidance on conducting an audit and using the checklist.

C REFERENCES

The publications and memos listed below are available from USEPA Office of Water Enforcement and Permits or the Pretreatment Coordinator in your Region. They are not available from the National Technical Information Service (NTIS).

A checklist for conducting pretreatment compliance inspections and audits is provided in the Pretreatment Compliance Inspection and Audit Manual for Approval Authorities (USEPA 1986b). The checklist provides a list of questions that should be considered during an audit or PCI, and is available from EPA Regional offices. The Regional or State Pretreatment Coordinator should be contacted before a PCI or an audit is done.

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☆U.S. GOVERNMENT PRINTING OFFICE: 1988-516-002/80122