EPA-430/9-74-013

EMERGENCY PLANNING FOR MUNICIPAL WASTEWATER TREATMENT FACILITIES

U.S. ENVIRONMENTAL PROTECTION AGENCY
Office of Water Program Operations
Washington, D.C. 20460

EMERGENCY PLANNING
FOR
MUNICIPAL WASTEWATER TREATMENT FACILITIES

FOR THE
MUNICIPAL OPERATIONS BRANCH
OFFICE OF WATER PROGRAM OPERATIONS
U.S. ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

CONTRACT NO. 68-01-0341

FEBRUARY 1974

EPA Review Notice

This manual is presented as helpful guidance and source material only; it is not a regulatory document. Mention of trade names or commercial products does not constitute EPA endorsement or recommendation for use.

ABSTRACT

A study has been made of emergency planning for municipal wastewater treatment facilities to ensure effective continued operation under emergency conditions. These emergency conditions could be imposed by natural disaster, civil disorders, strikes, faulty maintenance, negligent operation, or accidents.

Over 200 municipal treatment systems were contacted and asked to provide information for this project. This information was used to help identify the principal causes of failures within municipal treatment systems. Information on emergency planning and responses to emergency conditions was provided by these contacts.

The results of this study are presented in the form of a manual for the development of emergency operating plans for municipal wastewater treatment systems. The intent is to expand the concepts stated in the Federal Water Pollution Control Act Amendments of 1972.

This report was submitted in fulfillment of Contract 68-01-0341, under the sponsorship of the Office of Water Program Operations, Environmental Protection Agency.

TABLE OF CONTENTS

TABLE OF CONTENTS
(CONTINUED)

LIST OF FIGURES

SECTION I
CONCLUSIONS

1. Few municipal wastewater treatment systems currently have formal emergency operating plans. However, most treatment systems have developed informal plans to cope with specific problem areas within their systems. These plans call for personnel being familiar with emergency procedures and for sufficient emergency equipment being provided.

2. Each municipal wastewater treatment system owner should conduct a vulnerability analysis of his system. This analysis can be used to develop an emergency operating plan for his system. A sound plan will minimize and, in some instances, eliminate the adverse effects from emergencies affecting the system. These plans must be kept up to date to be of value when emergencies occur.

3. Each municipal wastewater treatment system possesses special conditions and unique situations that must be covered in an effective emergency response program for that system. There are, however, many emergency conditions that are shared by treatment systems across the country. These emergency conditions include personnel absence, equipment failure, power loss, blocked access, process failure, and communications loss. Preparing for these basic emergency conditions has an overlapping effect on many other, but less obvious, potential emergencies.

4. There is a need for better opportunities among persons involved with municipal wastewater treatment to exchange techniques and philosophies of emergency planning.

SECTION II
RECOMMENDATIONS

1. All municipal wastewater treatment system owners should establish comprehensive emergency operating procedures for their systems. Such procedures will help protect the health and welfare of system personnel and minimize adverse effects from emergencies.

2. The consulting engineers who prepare treatment system operation and maintenance manuals should place appropriate emphasis on the emergency operating program portion of these manuals. Proper attention to emergency programs at this stage will help ensure that acceptable programs are established.

3. Service organizations should continue to address emergency response programs. They should provide more space in their journals and more time at their conferences for this topic. These groups reach a large portion of the municipal wastewater treatment community and could do much to promote emergency planning. A parallel recommendation would be for treatment systems with established emergency programs to share their experiences with others in the field.

4. Municipal wastewater treatment equipment suppliers should include emergency operating instructions with their equipment. These instructions would permit consulting engineers to evaluate equipment with respect to flexibility during emergencies. Such information would enable treatment plant personnel to respond more efficiently to emergencies affecting that item of equipment.

5. Further studies should be made of the principal failures identified in this report. Emphasis should be placed on the redesign of vulnerable components and the application of technology from other fields to problem areas. Hopefully, such studies will produce acceptable solutions to these problems.

SECTION III
INTRODUCTION

Scope and Purpose

The primary function of municipal wastewater treatment facilities is to collect and treat municipal wastewaters so as to attain an interim national ". . . goal of water quality which provides for the protection and propagation of fish, shellfish, and wildlife, and provides for recreation in and on the water." The Federal Water Pollution Control Act Amendments of 1972 stipulate that this is to be accomplished by publicly owned treatment works in a consistent and reliable manner so as to meet effluent limitations based upon secondary treatment or any more stringent applicable limitation, by July 1, 1977, and so as to employ the best practicable waste treatment technology by July 1, 1983. The specific conditions and limitations will be identified in a permit issued to each point source discharge under the "National Pollutant Discharge Elimination System" as established by the Act.

Since the discharge of pollutants in excess of the effluent limitations defined in the plant's discharge permit is prohibited by the Act, it is essential that municipal wastewater plants, from the day of initial operation, effectively treat wastewater to be in compliance with those limitations. It is to assist in the accomplishment of this objective that this manual has been prepared.

It is expected that this manual will be used by consulting engineers, regulatory agencies, and municipal managers and their staff.

Consulting engineers may use it as a guide in writing the emergency operating program portion of any municipal wastewater treatment system operation and maintenance manual. The information contained herein is applicable to all treatment systems, regardless of the size plant or treatment process involved.

Regulatory agencies and EPA can use this manual in the evaluation of the emergency operating program of the operation and maintenance manuals.

Municipal department heads and staff will use the manual as a guide in the development of a plan suited to their plant's particulars. It may also be used by treatment plant staff to educate local governing bodies as to the need for additional funds to alleviate problems and deficiencies at their plant.

This manual has been prepared for the Environmental Protection Agency to provide a manual for emergency planning for municipal wastewater treatment facilities to ensure continued operation under emergency conditions.

The intent is to expand the concepts stated in the Federal Water Pollution Control Act Amendments of 1972.

Manual Format

Persons using this manual should be familiar with its organization and the general content of its sections.

Detailed discussions of the basic features of good emergency planning procedures for municipal wastewater treatment facilities are provided in the following sections:

The following is a synopsis of each of these five sections:

Causes of Emergencies

This section of the manual places all causes of emergencies into five categories: natural disasters, civil disorders, strikes, faulty maintenance, and negligent operation and accidents. A discussion of each cause and its relationship to the operation of a wastewater treatment facility is included in the section.

Effects of Emergencies

This section places the effects of all emergencies into six categories: personnel absence, equipment failure, power loss, blocked access, communications loss, and process failure. A discussion of each effect is included; also, in matrix form, the interrelationship of the causes, effects, and reasons for the effects of emergencies is included in the section.

Protection Measures

This section gives ten distinct measures required to protect wastewater treatment facilities from emergencies. Also included is a discussion of each protection measure and its role in the continued operation of a wastewater treatment facility.

Response to Emergencies

This section outlines the necessary steps required in responding to most emergency situations that may develop at a wastewater treatment facility.

Typical Emergency Response Program

This section discusses several emergency conditions, with appropriate responses, that may occur at the different system categories of a facility, i.e., collection system, pumping stations, pretreatment, primary treatment, secondary treatment.

SECTION IV
CAUSES OF EMERGENCIES

General

Emergencies at a wastewater treatment plant do not just happen — they are caused. The individual causes are sometimes numerous; however, many emergencies have certain similarities, particularly when they are traced back to their origin. For purposes of this manual, all causes of emergencies have been grouped under, or related to, one of the following:

Natural Disasters

An event, concentrated in time and space, which causes a community or a facility to suffer such damage as to disrupt its normal functions and operations can be termed a natural disaster.

Natural disasters which are most likely to affect the operation of a wastewater treatment facility to the extent of reducing the efficiency of the plant can be associated with one of the following:

Hurricane
Tsunami (tidal wave)
Blizzard
Forest and grass fire
Tornado
River flood
Earthquake

A study should be made to determine the potential for natural disasters in the areas where the municipal wastewater treatment system is located. Information on the natural disasters previously mentioned is available from agencies such as the U. S. Army Corps of Engineers and the Office of Civil Defense, Departments of Interior and Agriculture, and the Departments of Commerce and Transportation. Many state and local agencies, as well as volunteer disaster relief organizations such as the American National Red Cross, also have compiled information on disasters.

In all cases, in areas subject to one or more of the natural disasters listed herein, the treatment facilities should be prepared to ensure continued operation under emergency conditions imposed on that system by the disaster.

Civil Disorders and Strikes

People have been demonstrating against war, for and against various social movements such as housing, civil rights, women's liberation, etc., for a very long time. In more recent times, workers have banded together to form unions and have subsequently used the strike as an effective tool in making their demands heard.

According to the U. S. Treasury Department, there were over 5,800 bombings or attempted bombings during the 15-month period ending April 1970. As a result of these acts, 42 persons lost their lives, 384 were injured, and over $20 million of property damage was reported.

The interrelationship of these types of events – civil disorders and strikes – with the operation of wastewater treatment facilities poses a new type of threat. The importance of uninterrupted treatment of wastewater is of primary concern because of the ever-increasing need for pollution-free waters.

Several facets of a widespread civil disorder might well be the destruction of a sewage pumping station, the bombing of a power substation, or the dumping of toxic material into a manhole. Any one of these actions could interrupt the normal operation of a wastewater treatment facility and subsequently lead to pollution of nearby waters.

Faulty Maintenance

Equipment manufactured by man to help him in his everyday tasks is generally similar in one respect; it must be maintained or the equipment will cease to perform the task for which it was constructed. The manner in which equipment is maintained will generally determine how well it will perform its intended function and for how long. Good maintenance will result in equipment performing throughout its design period; however, poor maintenance or faulty maintenance will shorten the expected life of equipment.

Unexpected breakdowns due to faulty maintenance can greatly affect the continued operation of a wastewater treatment plant. Although the breakdown can possibly be repaired during a regularly scheduled repair program and probably does not represent an emergency, it is the effect on the continued satisfactory operation of the plant that can lead to the emergency condition.

Negligent Operation

All operations, regardless of application, large or small, require that certain procedures be followed for satisfactory performance. Applying this rule to a wastewater treatment plant's operation is no different. The operations required for the plant to function in a satisfactory manner require that certain procedures be followed, whether the procedures were established in-house, by a regulatory agency, or by the local governing body. To improperly follow established procedures constitutes negligent operation.

In many instances, negligent operation may not be as readily noticeable as faulty maintenance, but the emergency condition resulting from it could possibly be more severe because negligent operation could affect more units of operation before being discovered.

It is therefore imperative that sound operating procedures be developed and maintained to ensure the satisfactory operation of all wastewater treatment plants.

Accidents

The old saying "accidents don't just happen – they are caused" certainly applies when we speak of accidents relative to wastewater treatment plants and emergency conditions. Generally speaking, accidents result in personal injury and property damage, both of which have a direct bearing on a plant's operation. However, for this manual's use, an additional effect of accidents will apply, that effect being process failure. In direct connection with this kind of accident, concern is directed to the emergency condition arising from the accidental spill of toxic substance into the sewerage system. This one accident, if it goes undetected long enough, could shut down process units of the largest treatment plants for a considerable length of time, thus causing a severe emergency condition.

Summary

The causes of emergencies discussed here have a rather broad base, yet it must be realized that it would be an almost impossible task to derive a group of causes to cover every possible eventuality. The list as presented, however, will cover the majority of the more common causes of emergencies at wastewater treatment facilities.

SECTION V
EFFECTS OF EMERGENCIES

General

For every emergency condition, there is generally a cause and effect relationship. This situation is particularly true when applied to the emergencies relating to a wastewater treatment plant. Each of the causes discussed in Section IV does not have the distinction of having only one distinguishable effect. To the contrary, the effects to be discussed in this Section can be linked to several causes. At the close of this Section, this complexity will be exemplified by the use of a matrix showing the interrelationship between cause and effect.

Personnel Absence

All plants, whether large or small, require personnel to ensure a plant's satisfactory operation. For small plants a visit every other day or once a week may suffice. The largest plants require permanent staff of a hundred or more technically trained people. Regardless of the size of the plant, it is essential that properly assigned inviduals perform their tasks routinely, as assigned.

If, for some reason, individuals are prevented from performing their assigned duties, or are prevented from reaching the plant, then an emergency condition is imminent which could lead to total plant failure.

A number of causes may produce personnel absence on an individual basis; however, for large scale absenteeism, the causes are related to such things as natural disasters, civil disorder, and strikes. The following is a partial list of reasons for personnel absence related to the causes covered in Section IV:

- Wind
- Flooding
- Fire
- Injury or threat of injury
- Picket lines
- Blocked access

Equipment Failure

All wastewater treatment plants utilize equipment in their treatment processes. Needless to say, it is very important that the equipment perform or a plant shuts down.

Isolated incidences of equipment failure are to be expected in all treatment plants; however, most equipment breakdowns of this type can be repaired on a routine basis. It is the failure of equipment on a large scale basis that is of primary concern in this report, that is, failure as a result of natural disasters, civil disorders and strikes, faulty maintenance, negligent operation and accidents.

The following are a few of the many reasons for equipment failure as related to the causes in Section IV:

Flooding
Structural damage
Loss of power
Sabotage
Overloaded conditions
Clogged pipelines
Overheating of bearings and motors

Power Loss
A dependable, uninterrupted supply of electrical power is very important in this country today. This type of supply is essential to a wastewater treatment plant because the entire process is generally dependent upon electricity for power. In the flat areas, where large numbers of sewage pumping stations are used, a dependable supply of electrical power is required throughout the collection system as well as the plant.

Generally speaking, a dependable supply of electrical power is at our "fingertips" – that is, under normal conditions. It is under other than normal conditions with which this manual is concerned. There are any number of reasons for power loss – local or area-wide – which can be attributed to the emergency condition causes in Section IV; following are some of them:

Flooding
Wind
Sabotage
Salt spray on power lines
Structural damage
Ice on power lines
Fire

Blocked Access

As used in this report, blocked access refers to blocked access routes or roads that lead to a treatment plant or a pumping station. It is difficult to discuss blocked access and its importance to the operation of a wastewater treatment plant, without mentioning a related emergency effect, that is, personnel absence.

It was shown previously that blocked access could be a reason for personnel absence; however, there are many reasons for blocked access as related to the causes of emergencies. Following are some of them:

Flooding
Wind
Slides
Debris
Road washouts
Fire
Sabotage

Communications Loss

Communications play a very important role in the day-to-day operation of wastewater treatment plants. Generally speaking, communications are taken for granted in the everyday routine operations, but their importance becomes known during emergency situations. In Section VI it will be shown that many of the protection measures suggested could not be implemented if communications were disrupted. Because of this, some of the reasons for communications loss should be exemplified as follows:

Flooding
Wind
Sabotage
Fire

Process Failure

Process failure, as used in this manual, can be either a partial or total loss of a wastewater treatment plant's processes. In either case, the satisfactory performance of the plant would be altered to such an extent that the primary function of the plant would be changed considerably — treating sanitary sewage to prevent pollution of our waters.

Some of the emergency effects discussed thus far, independently, could result in partial process failure and eventually in total failure if the condition exists long enough. Contrastingly, some of the effects could result in complete process failure in a short period of time.

The following is a partial list of reasons for process failure as related to causes given in Section IV:

- Flooding
- Loss of power
- Sabotage
- Personnel absence
- Toxic spill

Summary

An examination of Section IV and V reveals that there is an interrelationship between causes and effects of emergencies and also between effects and reasons. Because of this interrelationship, the following matrix has been developed to aid in exemplifying the situation:

CAUSES	EFFECTS	REASONS FOR EFFECTS
Natural Disaster Civil Disorder	Personnel Absence	Flooding Wind Fire Injury Picket Lines Blocked Access
Natural Disaster Civil Disorder Faulty Maintenance Negligent Operation Accidents	Equipment Failure	Flooding Structural Damage Loss of Power Sabotage Overload Condition Clogged Pipelines Overheating
Natural Disaster Civil Disorder Faulty Maintenance Negligent Operation Accidents	Power Loss	Flooding Wind Sabotage Salt Spray on Lines Structural Damage Ice on Lines Fire
Natural Disaster Civil Disorder	Blocked Access	Flooding Wind Slides Debris Road Washouts Fire Sabotage
Natural Disaster Civil Disorder	Communications Loss	Flooding Wind Sabotage Fire
Natural Disaster Civil Disorder Faulty Maintenance Negligent Operation Accidents	Process Failure	Flooding Loss of Power Sabotage Personnel Absence Toxic Spill

SECTION VI
PROTECTION MEASURES

Vulnerability Analysis

A municipal wastewater treatment system includes the collection lines, pump stations, and treatment plant. The system requires trained personnel, power, materials, supplies, and communications to function properly. It is essential to estimate both the strengths and weaknesses of an individual system in relation to anticipated emergency conditions prior to drafting an emergency operating plan. A vulnerability analysis of the system is an estimation of the degree to which the system is adversely affected, in relation to the function it must perform, by an emergency condition. This analysis should include power supply, communications, equipment, material, supplies, personnel, security, and emergency procedures. After performing a vulnerability analysis upon a given system for several possible emergency conditions and then comparing the results of the various analyses, certain key – most vulnerable – components of the system can be identified. The following steps should be followed in making a vulnerability analysis:

1. List components of treatment system.
2. Select emergency condition to be investigated.
3. Estimate effects of emergency condition on each component of system; use vulnerability worksheet.
4. Estimate treatment system's ability to perform its intended function during the emergency.
5. Identify key system components responsible for the failure when a system fails to perform.

When identifying those components which are partially or totally incapacitated by the emergency condition, attention should be given to those system components which are interrelated with other components so as to make the entire system inoperative. These components are the most vulnerable. The emergency operating plan should indicate priorities of repair of the system and alternate provisions in case of light or severe damage. The following methods can be employed to reduce the system's vulnerability:

1. An optimum preventive maintenance and testing program

2. Duplication and separation of vital works

3. Minimizing dependence on power and pumping

4. Provision for more than one power source and/or transmission line

5. Flexibility in operation of treatment works

6. Maintenance of adequate chemical supplies

7. Provision of dual power sources, on-site storage of fuel and auxiliary power units, remote and/or automated controls, and ready conversion of automatic controls to manual operation

8. Provision of portable pumps with fuel-operated units

9. Provision at major pumping stations of more than one incoming and discharge line

10. Training of regular and auxiliary personnel in emergency operations and procedures

11. Conducting emergency operations exercises periodically

Some of the items just listed will be dealt with in more detail throughout the remainder of this Section.

Included herein is a sample vulnerability analysis worksheet to be used as a guide in performing a vulnerability analysis of any given treatment system; reference is made to Figure No. 1.

CAPITOL CITY
WASTEWATER TREATMENT PLANT
LAYOUT

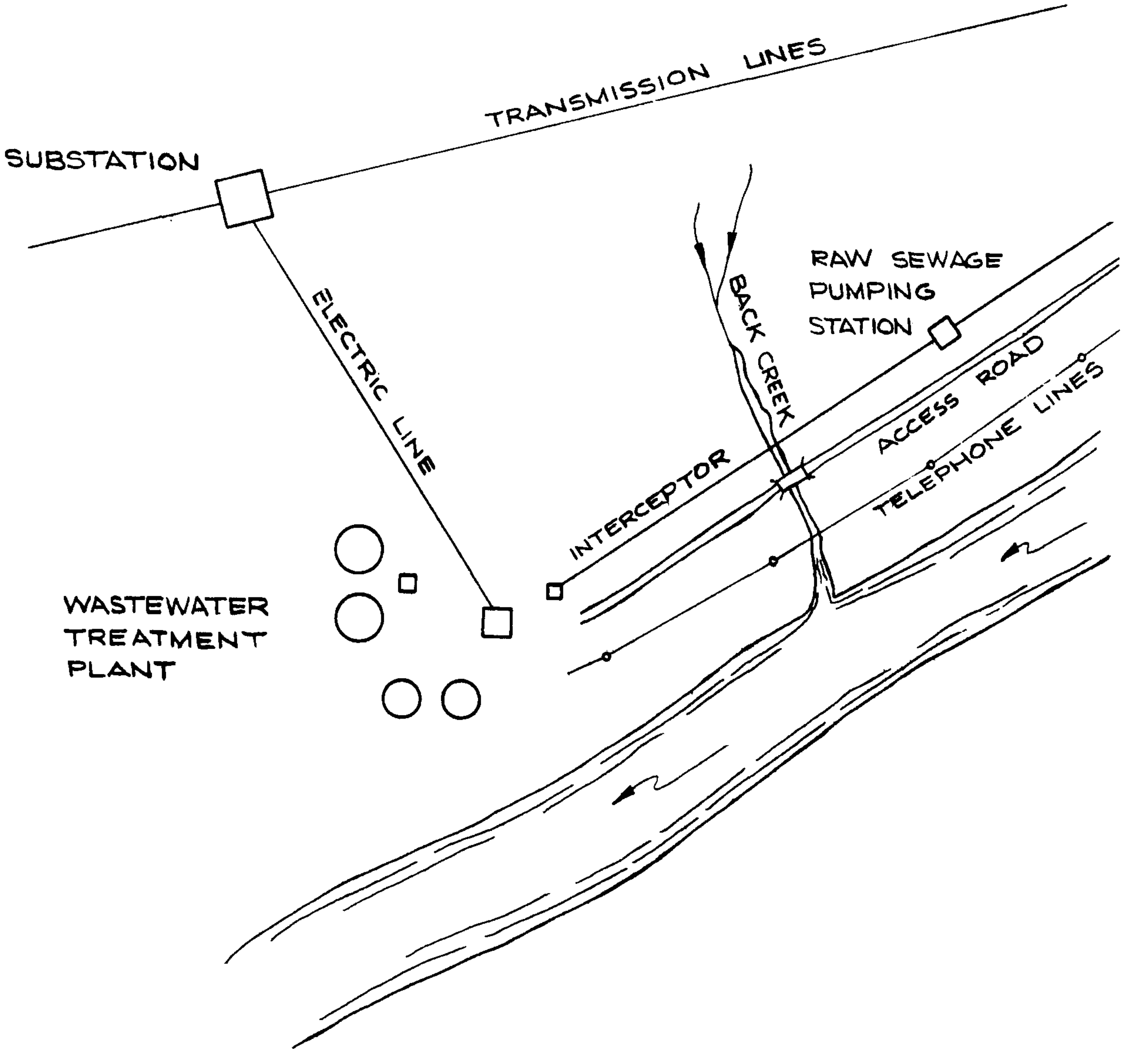

FIGURE NO. 1 SAMPLE PLANT LAYOUT FOR VULNERABILITY ANALYSIS

SAMPLE

VULNERABILITY ANALYSIS WORKSHEET

TREATMENT SYSTEM: Capital City Wastewater Treatment Plant

ASSUMED EMERGENCY: Flood (100 years)

DESCRIPTION OF EMERGENCY: The flood will cause considerable damage to low lying areas. Bridges will be closed, utility poles downed, and electrical power interrupted.

SYSTEM COMPONENT	EFFECTS OF EMERGENCY TYPE AND EXTENT	PREVENTION RECOMMENDATIONS
COLLECTION LINES	60" interceptor could be washed out at Back Creek crossing	1. Encase line in concrete. 2. Maintain pipe & fittings to repair damaged section. 3. Provide portable pumps to bypass break. 4. Contract for major emergency repair services.
PUMPING STATIONS	Power failure	1. Provide for power from two separate sub-stations. 2. Provide stand-by diesel generators.

FIGURE NO. 2 VULNERABILITY ANALYSIS WORKSHEET

SAMPLE
VULNERABILITY ANALYSIS WORKSHEET

SYSTEM COMPONENT	EFFECTS OF EMERGENCY TYPE AND EXTENT	PREVENTION RECOMMENDATIONS
PRETREATMENT	Power failure Access road blocked preventing delivery of chemicals	1. Provide for power from two separate sub-stations. 2. Provide standby diesel generators. 3. Stock sufficient chemicals for emergency use. 4. Provide alternate access routes to plant.
CLARIFICATION	Power failure	1. Provide for power from two separate substations. 2. Provide standby diesel generators
SECONDARY UNITS	Power failure	1. Provide for power from two separate substations. 2. Provide standby diesel generators.
SLUDGE HANDLING	Power failure	1. Provide for power from two separate substations. 2. Provide standby diesel generators.

FIGURE NO. 2 VULNERABILITY ANALYSIS WORKSHEET (Continued)

SAMPLE
VULNERABILITY ANALYSIS WORKSHEET

SYSTEM COMPONENT	EFFECTS OF EMERGENCY TYPE AND EXTENT	PREVENTION RECOMMENDATIONS
POWER SUPPLY	Temporarily interrupted due to transmission lines down.	1. Provide for power from two separate substations. 2. Provide standby diesel generators.
COMMUNICATIONS	Telephone lines downed	1. Provide for radio communications, at plant and in vehicles. 2. Use portable two-way radios within plant.
PERSONNEL	Access road blocked due to bridge washout at Back Creek Personnel isolated at plant and at homes	1. Select alternate routes to plant. 2. Provide supplies for persons stranded. 3. Provide auxiliary personnel. 4. Coordinate with city street department for bridge repairs.

DATE: July 11, 1973 ANALYST: RAL

FIGURE NO. 2 VULNERABILITY ANALYSIS WORKSHEET (Continued)

Warning Devices

All wastewater treatment systems regardless of size need warning devices of some type. The small systems require less sophisticated equipment than the large systems; however, the need is always present to warn the man on duty of impending or existing emergencies.

There are many individual types of devices available, but generally they can be classified as follows:

1. Alarms – which may be audio-visual
2. Indicating lights – tell the operator which equipment is required to run, equipment running, power on and off, etc.
3. Indicators – mechanical (gauges), electrical (counters, indicators, recorders) or electro-mechanical (flow and/or pressure recorders)

Many distinct uses can be made of warning devices; the following are just a few:

1. Low pressure (discharge, suction, or level)
2. No pressure (discharge, suction, or level)
3. Low well water level
4. Flooding
5. Air in pump
6. Air loss
7. Power failure (transfer to standby source)
8. Equipment failure
9. Pump reversal
10. Freezing

The above is only a partial listing of how warning devices could prove useful. There are many more uses wastewater treatment plants might find for warning devices which would be unique for each plant.

Emergency Equipment Inventory

An inventory should be made of equipment, materials, and chemicals that are available within the treatment system. A sample wastewater treatment system emergency inventory worksheet, Figure No. 3, follows this discussion. Using this inventory and the results of the system vulnerability analysis, additional emergency equipment and supplies may be purchased and stockpiled, or arrangements made to obtain these items through mutual aid agreements or outside contracts.

Stockpile emergency equipment/supplies might include:

1. Lightweight quick-coupling pipe
2. Portable pumps
3. Generator sets
4. Mobile chlorinators
5. Chemicals

Standby and/or Duplicate Facilities

Standby facilities refer to equipment installed for use when the primary equipment fails – it is a substitute piece of equipment. A diesel generator is an example of a standby emergency source of electrical power should the primary source fail.

Duplicate facilities refer to repetition of installation of equipment such as: two screens, two grinders, two clarifiers, two digesters, two chlorinators, etc. In the case of duplicate facilities, both are generally in use at all times. In some instances, such as with grinders and grit removal equipment, the units are used alternately.

The necessity of having standby equipment is quite obvious. Since an entire plant's operation is wholly dependent upon electrical power, a standby source would be required should the primary source fail – that is, if the function of the wastewater treatment plant is

WASTEWATER TREATMENT SYSTEM
EMERGENCY INVENTORY

SYSTEM: ____________________

PREPARED BY: ____________________ DATE: __________
(Signature)

DUPLICATE EQUIPMENT IN STOCK

DESCRIPTION	MAKE	SIZE	TYPE	VOLTAGE	HP	CAPACITY	NO.

PARTS & COMPONENTS IN STOCK

DESCRIPTION	SIZE	NO.	APPLICATION IN SYSTEM

FIGURE NO. 3 SAMPLE INVENTORY WORKSHEET

EMERGENCY EQUIPMENT & REPAIR TOOLS

DESCRIPTION	NO.	APPLICATION IN SYSTEM

PIPE	SIZE					
	TYPE					
	LENGTH					

AVERAGE CHEMICAL STOCK	TYPE				
	FORM				
	QUANTITY				

COMMUNICATIONS EQUIPMENT

DESCRIPTION	LOCATION

MAPS AND FACILITY LAYOUT DETAILS

OFFICIAL AUTHORIZING
INVENTORY

FIGURE NO. 3 SAMPLE INVENTORY WORKSHEET (Continued) to remain unaltered. Standby sources of power, whether at treatment plants or at remote pumping stations, are being required by many regulatory agencies.

In like manner, duplicate facilities are being required by many regulatory agencies. This requirement is necessary for the assurance of continued plant operation should a piece of equipment such as an aerator, blower, pump, clarifier mechanism, etc., break down and thus render a process useless. Under this condition, the flow can be channeled through the duplicate facility with little loss of treatment efficiency.

Adequate Preventive Maintenance

All equipment regardless of design, construction, and use requires maintenance at some time during its lifetime. To perform such maintenance in an orderly manner and in accordance with a preplanned scheme for the purpose of obtaining the useful design life from a piece of equipment is called preventive maintenance.

Always maintain good records on all equipment purchased. Such things as date of purchase, equipment manufacturer, local service representatives's name and phone number, instruction manuals, service instructions, etc., should be filed on each piece of equipment for handy reference.

If service contracts are purchased on equipment, do not perform any preventive maintenance unless specifically authorized by the service representative. Any "jack-leg" maintenance by an inexperienced person could do more damage than good.

All preventive maintenance performed by waste treatment plant personnel should always be done in accordance with equipment manufacturer's recommendations. In most instances, maintenance in excess of that recommended by equipment manufacturers is a waste of time, effort, and money.

Reference should be made to EPA Manual "Maintenance Management Systems for Municipal Wastewater Facilities," Contract No. 68-01-0341, for an in-depth study of plant maintenance.

Treatment System Records

The program for the protection of essential records, maps, and inventories is an important part of any emergency operating plan. It is especially important that maintenance crews and service vehicles be provided with maps and current records showing location and condition of collection lines. Full size copies of maps and other detail sheets can be made each year and kept in a vault that is not subject to flooding. Copies of the layouts of important pumping installations can also be kept here. These items are available for immediate use and can be reproduced as required. These records are readable and do not have to be processed by any further mechanical steps. The essential records that should be maintained include the following:

1. Emergency facility and auxiliary personnel – names, addresses, telephone numbers, disaster responsibilities, skills, availability of transportation, etc.

2. Amounts, types, and locations of emergency stockpiled equipment, materials, supplies and chemicals (including repair items), both belonging to the facility and that are available in the area

3. Vehicles and equipment for hauling emergency supplies

4. Treatment equipment such as auxiliary chlorinators available

5. Estimates of requirements to meet severe emergencies

Industrial Waste Inventory and Monitoring System

Inventory all industrial contributors to the municipal treatment system. Locate each industry on a collection system map and list the potential hazardous spill materials of each industry. Record the names and phone numbers of key personnel with each industry. Install industrial waste monitoring equipment in the sewer network at several critical locations. The waste monitoring equipment is part of a warning system to alert treatment plant operators of spills. Require that all industries report hazardous materials spills immediately upon discovery of the spill. Stockpile necessary neutralizing chemicals for emergency use. Inspect industrial waste monitoring equipment on a routine basis to make certain it is functioning properly.

Following is a sample industrial waste inventory form, Figure No. 4.

Name and Location	Industrial Waste Description	Key Personnel
Industries should be in alphabetical order. Location should include manhole where industrial waste enters municipal system.	List waste by common name, chemical nomenclature, and trade name, if applicable. Also list any other hazardous materials on hand that can potentially enter municipal treatment system and give neutralizing agents, if applicable.	Give names, titles and phone numbers of all key personnel. At least one number should be designated as a 24-hour a day number.
	SAMPLE	
ACME Mfg. Co. — Industrial waste is discharged into manhole at intersection of Main and Pine Streets.	Waste is acidic, pH below 4.0 due to presence of sulfuric acid, H_2SO_4. There exists potential for a spill of concentrated sulfuric acid which can be neutralized with strong basic materials such as lime.	John Doe Plant Manager (phone) Bill Smith Maintenance Supt. (phone) Plant Security Office (phone)* *24-hour number

FIGURE NO. 4
SAMPLE INDUSTRIAL WASTE INVENTORY FORM

Emergency Operations Organization

In large municipal wastewater treatment systems, a director has overall responsibility for the emergency operating plan — in small plants this responsibility rests with the plant operator or superintendent. The wastewater treatment superintendent and the collection system superintendent are responsible for implementing the emergency plans within their respective areas and they report directly to the treatment system director. If the treatment system is organized so that a single individual is in charge of the treatment facilities and the collection system, then the individual facility superintendent has overall responsibility for the emergency operations plan within his jurisdiction. The following is a listing of the treatment system staff and their corresponding emergency responsibilities:

A. Facility Superintendent:

1. Upon receipt of emergency condition message, activates appropriate portion of emergency operations plan based on initial alert information.

2. Brings together key personnel to assess severity and outline response actions. Key personnel might include: Maintenance Supervisor, Chief Operator, Chief Chemist, and representatives from organizations providing assistance through mutual aid agreements.

3. The various department heads are responsible for mobilizing their staffs and the facility superintendent should support this effort.

4. Notify State Water Pollution Control Organization of emergency situation, if applicable, and/or request assistance as required.

5. Monitor and support all emergency response actions as required until normal operation is restored.

6. Critique emergency operations plan and upgrade the plan as required. Areas to be reviewed include: response time; adequacy of emergency procedures, equipment, communications, and personnel training; process flexibility; and

performance of auxiliary personnel and mutual aid agreements.

B. Maintenance Supervisor:

1. Mobilize emergency maintenance teams as dictated by nature of emergency.

2. Support emergency operations actions with personnel, equipment, and maintenance skills.

3. Coordinate with organizations providing specialized maintenance skills and equipment through mutual aid agreements or contracts.

4. Monitor and support as required all emergency maintenance team actions until normal operation is restored.

5. Critique maintenance aspects of emergency response and provide input to facility superintendent's overall emergency operations critique.

C. Chief Operator:

1. Mobilize emergency operating staff as dictated by nature of emergency.

2. Provide facility superintendent with input concerning operational actions to minimize public health and environmental impact of incident.

3. Monitor and support as required all emergency actions involving operators until normal operation is restored.

4. Critique the emergency response as viewed by the plant operator and provide facility superintendent with input to his overall emergency operations critique.

D. Chief Chemist:

1. Mobilize laboratory staff and conduct sampling for process control and severity analysis as required.

2. Ensure facility superintendent and chief operator are kept up to date on results of sampling during the emergency.

3. Monitor and support as required activities of laboratory personnel.

4. Critique actions of laboratory personnel during emergency situation and provide input to facility superintendent for his overall critique.

It should be apparent from the results of the vulnerability analyses that conditions can occur for which the treatment system is not adequately staffed or where staff members are not able to reach their assigned emergency positions. Auxiliary personnel obtained from other departments within the local government or through mutual aid agreements should be trained as backups for the regular staff. Procedures for alerting these auxiliary personnel should be clearly outlined and rehearsals conducted to keep these personnel up to date on emergency operating procedure.

Auxiliary personnel should receive similar training in plant operation, maintenance, communications, and first aid as that received by the regular system staff. Arrangements should be made for auxiliary personnel to work periodically with their counterparts on the regular staff. Backup personnel should be provided at all positions to include department heads and facility superintendent.

Emergency Response Center

The Emergency Response Center is located in the main building of the treatment facility. The senior operator on duty is responsible for the center and all individuals who perform this function must be adequately trained and thoroughly familiar with the emergency operations plan.

The main control panel at the Emergency Response Center contains the pumping station high water and power failure alarms and the high water alarms at several critical manhole locations. Upon receipt of an alarm, the operator on duty dispatches the maintenance crew that is on call to the scene. The on-duty operator maintains constant communications with the emergency maintenance crew by radio. If the problem is beyond the emergency crew's capability, the on-duty operator alerts the maintenance supervisor and facility superintendent. A current telephone call list is maintained at the emergency center as well as collection system maps and treatment facility piping and wiring diagrams.

Various alarms are also provided within the treatment facility and these alarms are also tied into the main control panel at the Emergency Response Center. When emergencies arise within the treatment facility, the on-duty operator immediately reports the condition to the facility superintendent. Appropriate personnel respond to the emergency with the necessary resources.

When emergency condition notices are received by telephone at the Emergency Response Center, the operator on duty should ensure all pertinent information surrounding the emergency is accurately recorded.

Figure No. 5 is an emergency condition flow diagram to aid in responding to emergencies.

Mutual Aid Agreements

There are many agencies and businesses within a community which can be very helpful during emergencies. Mutual aid agreements should be made with such agencies and businesses to help during emergencies. Some examples of groups with whom mutual aid agreements should be developed are as follows:

1. Industrial firms
2. Construction companies
3. Electric, gas, and telephone utilities
4. Fire and police departments
5. Civil defense organizations
6. Health departments
7. Rescue squads

EMERGENCY CONDITION FLOW DIAGRAM

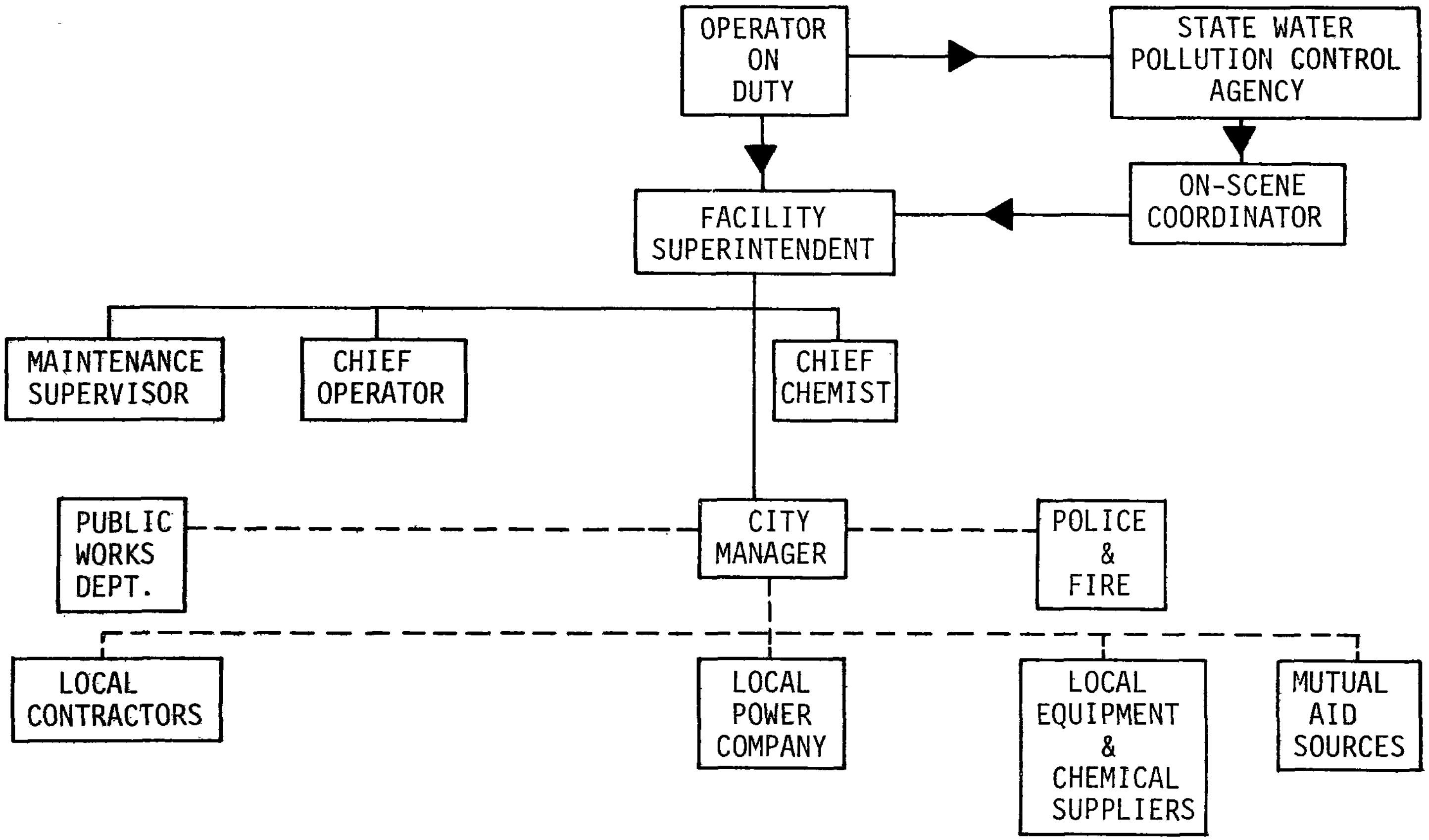

FIGURE NO. 5 SAMPLE EMERGENCY CONDITION FLOW DIAGRAM

Mutual assistance programs with the above organizations provide the following:

1. Emergency equipment and supplies

2. Spare parts

3. Specialized maintenance skills

4. Auxiliary operating personnel

5. Chemists and/or sanitary engineers

Local police officials should be asked to critique the treatment system's security measures. The police department's recommendations on locks, fencing, and lighting should be implemented., The police department should be asked by the treatment system owners to make routine checks at the treatment facility and at remote pumping stations. Alert the police to areas where vandals have attempted to obstruct manholes or where illegal dumping has occurred. In the event of street spills of explosive or toxic materials, the police should be instructed to immediately notify the operator on duty at the treatment facility and provide the following information:

1. Type and quantity of material involved

2. Location of spill

3. Time of spill

The police officials should be briefed on the role their department may be asked to play during emergencies within the treatment system. For example, their mobility and communications capability may prove valuable in locating the source of hazardous material spills.

Local fire department officials should visit the treatment facility and pump stations and make recommendations on ways to minimize fire hazards. The fire department should also check the adequacy of existing fire-fighting equipment within all facilities and routinely check fire extinguishers, wiring, and combustible material storage areas. Plant personnel must receive first aid training from the fire department and a program should be adopted to upgrade training periodically. The chlorine facilities within the treatment system should be studied by both fire department officials and treatment system personnel. Coordination with the fire department must be established for responding to emergencies involving chlorine gas. Provide fire department officials with plans of all pump stations and treatment facility buildings to aid them in preparing responses to potential fires within the treatment system.

Police Department Checklist:

1. Critique existing treatment system security measures.

2. Make routine checks of treatment facility and pumping stations.

3. Notify treatment plant in the event of a street spill of hazardous materials.

4. Be prepared to assist during emergencies within the treatment system.

Fire Department Checklist:

1. Routinely check fire-fighting equipment within the facility and inspect facility for potential fire hazards.

2. Provide first aid instruction to treatment system personnel.

3. Coordinate with treatment system personnel on safety precautions to be used with chlorine gas.

Reference should be made to Figures No. 6 and No. 7 for a sample mutual aid agreement form and information fact sheet.

MUTUAL-AID AGREEMENT *

EMERGENCY SITUATIONS COULD ARISE IN A MUNICIPALITY'S WASTEWATER TREATMENT SYSTEM THAT WOULD REQUIRE ASSISTANCE FROM AN ADJOINING MUNICIPALITY TO RESTORE NORMAL OPERATION.

IF AN EMERGENCY SITUATION ARISES IN ______________________ (City) OR ______________ (City) THE OFFICIALS IN BOTH MUNICIPALITIES AGREE TO SUPPORT EACH OTHER DURING THE EMERGENCY.

EACH CITY HAS A CONTINGENCY PLAN FOR RESPONSE TO EMERGENCIES AFFECTING ITS WASTEWATER TREATMENT SYSTEM. THE ______________ (City) AGREES TO SUPPORT ______________ (City) IN THE FOLLOWING AREAS: ______________ (Firefighting, Rescue Crews, Communications, Portable Chlorination, Operational/ Maintenance, Personnel, etc.)

____

____ TO THE EXTENT POSSIBLE UPON REQUEST INITIATED BY:

______________ Name	______________ Name
______________ Title	______________ Title
______________ City	______________ City

PERSONNEL RESPONDING TO THE REQUESTS FOR ASSISTANCE UNDER THIS AGREEMENT WILL REMAIN UNDER THE CONTROL OF THE CITY PROVIDING THEM.

______________ Signed	______________ Signed
______________ Name	______________ Name
______________ Title	______________ Title
______________ City	______________ City

*Similar to format suggested by Planning Section, Virginia Office of Civil Defense.

SAMPLE

FIGURE NO. 6 MUTUAL AID AGREEMENT FORM

SAMPLE MUTUAL AID INFORMATION FACT SHEET

NAME	DESCRIPTION OF ASSISTANCE	COORDINATION INFORMATION
Public Works Department	Department of Parks maintains 1,000 feet of 6 inch quick coupling aluminum pipe that is available to assist treatment system during emergencies.	To obtain pipe, contact Dept. of Parks (Phone) during normal working hours or call city switchboard (Phone) after normal working hours.
City Water Department	Water Department maintains 2 portable chlorinators which can be used for emergencies within the wastewater treatment system.	Contact Water Department Supt. (Phone) or operator on duty at main filter plant (Phone).
ABC Construction Company	4 tractor mounted back-hoes are available on a 24-hour basis.	Contact company main office (Phone) or after hours call John Doe, Equipment Foreman (Phone).
ACME Welding Company	Machine shop facilities and a portable welding machine are available on a 24-hour basis.	Call: (Phone) Office (Phone) Home (Phone) Home

FIGURE NO. 7
SAMPLE MUTUAL AID INFORMATION FACT SHEET

SECTION VII
RESPONSES TO EMERGENCIES

General

A response plan to emergencies is necessary to ensure effective continued operation of a municipal wastewater collection/treatment system under emergency conditions. The emergency condition may be the result of natural disasters, civil disorders, faulty maintenance, negligent operations or accidents.

There are four basic elements to any sound emergency response plan:

1. Rapid and positive detection system.

2. Response procedure with predetermined patterns of action.

3. Backup capability in the event the local response capability proves insufficient.

4. Warning system to alert the next level of responsibility that an emergency condition exists.

An emergency condition affecting a municipal wastewater collection/treatment system generally results in a spill of raw or inadequately treated wastewater. These spills can be placed in three major categories:

1. Plant problems

2. Pumping station problems

3. Collection line problems

A good emergency response plan should consider all three categories. The following observations are applicable to emergency response plans for municipal wastewater collection/treatment systems:

1. The most desirable condition is to have the emergency response performed at the lowest level. The plan must provide adequate tools to allow the personnel nearest the emergency to cope with all but the most severe incidents.

2. The "checklist" method is best for delineating procedures and responsibilities for reporting and responding to emergencies. Lengthy manuals are of questionable value during an emergency.

3. There are key people involved in any successful plan execution. These key people must be identified and their roles clearly defined.

4. The importance of training and rehearsal as part of emergency plans cannot be overstated. An essential part of any rehearsal is the critique which follows. Comments and information from critiques will ensure that the plan remains viable.

5. Since it would be impossible to predict the conditions surrounding all emergency situations, the treatment system should be provided with adequate staffing and flexibility. This aspect of preventing failures should be an important design consideration.

6. The review of the emergency response capabilities in a given municipality should include the feasibility of using private firms for services. Also "mutual assistance" agreements with nearby facilities should be considered.

7. Power failures are of concern to all municipal wastewater treatment systems. To determine the probability of power failure at a given facility, coordinate with the local power company. Based on this input, alternate power sources can be selected to ensure optimum electric service.

8. In developing an emergency plan, it should be policy to make maximum use of all departments in a municipality. This might include using such items as radios in the police department and emergency equipment maintained by the public works department.

9. Where there are several small plants and/or pumping stations that are not staffed 24 hours per day, provisions should be made for a maintenance team to visit the facilities on a periodic basis. An alarm system should be provided at each location. As a minimum requirement, the alarm system should respond to power failure

overload, no load, and high water. The alarms should be connected to a central alarm center where personnel have been instructed in proper emergency response procedures. Alarm system should be failsafe. If alarm system actuates standby equipment, provisions should also be made for monitoring the standby equipment.

10. Where roving maintenance crews are used, their vehicles should be equipped with radios. Telephone communications should be provided along with the tools necessary to perform all anticipated maintenance functions. The crew should consist of two individuals and be trained in all safety and emergency aspects of their job.

11. Bolt-down or lock-down manhole covers should be used in areas where collection lines have been intentionally obstructed. Emergency and repair crews should be provided with necessary tools and/or keys for removing these manhole covers.

12. To ensure prompt notification of problems at remote facilities, emergency phone numbers should be posted on all pump stations and treatment plants. A color-coded exterior light alarm system could also be employed as a backup.

13. Standby equipment should be put in service periodically as part of the overall response program.

14. A suitable spare parts inventory should be maintained to avoid delivery delays and provide components needed during emergency. In addition to parts, sections of force main pipe and gravity pipe should be kept and repair crews rehearsed to provide quick response to collection line breaks.

15. A study should be made of the municipal wastewater collection/treatment system for the purpose of selecting sampling points. With sampling points selected prior to an actual emergency, dispatching sampling teams with appropriate equipment can be accomplished efficiently and with a minimum of confusion.

16. It is important, in any emergency plan for a municipal wastewater collection/treatment system, to provide for chlorination of spills or raw or partially treated wastewater.

17. Metering equipment maintenance can be contracted to the equipment manufacturer economically in some instances.

18. Where wastewater treatment facilities have only a single operator after normal working hours, these facility operators should be required to give a status report to a 24-hour central telephone switchboard on an hourly basis. If no report is received, the switchboard operator alerts a predetermined supervisor.

19. The chlorine building at the treatment facility should be provided with an emergency alarm system which is actuated upon pressure differentials resulting from equipment breakdown in the chlorine distribution system. Actuation of the alarm should automatically start the exhaust fans. A repair kit and appropriate safety equipment should be provided to correct all but the most severe problems with the chlorination system. All operational and maintenance personnel should be thoroughly trained in safety precautions involving chlorine. Local fire departments and rescue squads should also be alerted to potential for chlorine emergencies that exist at treatment plant.

20. A study should be made of the collection system to determine potential sources of hazardous material spills. Early warning system for reporting spills should be established. Preplanned actions for responses to spills of various materials should be rehearsed.

21. To ensure proper operation of standby generators, they should be run on a scheduled basis. Heaters should be provided to ensure cold weather starting. Battery charges can also be provided to assist in starting.

22. Toxic substances can kill the bacteria in sludge digesters. This situation should be anticipated and an acceptable method for disposing of sludge after this occurs should be arranged.

23. Mobile gasoline powered pumps should be made available to respond to pumping station emergencies. All pump stations should be provided with an emergency connection so the mobile pumps can be connected quickly and efficiently.

24. Ensure that as-built drawings of the facility are accurate. During emergencies these drawings may be invaluable in locating valves, electrical boxes, etc., that are needed to minimize effects of incident.

25. Areas that are subject to flooding due to equipment or line failures, such as pump pits and digester buildings, should be studied. Cutoffs should be provided and any special tools required when these areas are flooded should be purchased.

26. Construction photographs should be properly cataloged and cross-referenced with engineering drawings. These photos can be of great value in estimating severity of an emergency condition.

Response to Emergency Effects

In Section V there are listed six effects of emergencies to which responses might be stated more explicitly. However, to give specific responses to each effect would involve repetition due to the interrelationship of the effects and responses. Therefore, the following response procedures, generally, are applicable to the emergency effects under most circumstances.

1. Analyze all emergencies to determine the proper course of action.

2. Implement protection measures where applicable.

3. Dispatch pretrained crew where applicable.

4. Check spare parts inventory before ordering parts.

5. Take out of operation the unit process only as a last resort.

6. Keep down-time to a minimum.

7. Critique the response plan.

SECTION VIII
TYPICAL EMERGENCY RESPONSE PROGRAM

General

A spill of raw or inadequately treated municipal wastewater can create substantial health hazards and have adverse effects on the environment. This Emergency Response Plan (ERP) has been developed to minimize spill effects by ensuring effective continued operation of the treatment system under emergency conditions imposed by natural disasters, civil disorders, faulty maintenance, negligent operation or accidents.

The objectives of this Emergency Response Plan are:

1. To eliminate or minimize adverse effects from emergency situations affecting the treatment system.

2. To develop procedures for properly responding to emergencies.

3. To provide instruction for system personnel to ensure they understand their responsibilities during emergency situations.

4. To provide inventories of available emergency equipment and outline existing mutual aid agreements and contracts with outside organizations for specialized assistance.

5. To emphasize importance of critiquing all ERP's.

Emergency Response Plans all have a common base. This common base consists of assessment of severity and response to the emergency so as to minimize environmental impact of the incident. This is due largely to the many different types of emergencies that create similar effects on the wastewater treatment system. Each system has its own characteristics and problems. The specifics of an Emergency Response Plan must therefore be tailored to allow for the peculiarities of the specific system. The purpose of an ERP is to minimize damage and to provide the most efficient utilization of resources available to the system owner. The objectives of any ERP can be achieved only with trained personnel, sufficient emergency equipment and material.

Discussion

In Section VII, responses to emergencies were discussed in general terms. It is the purpose of this Section to give responses to some typical emergencies that might develop at a wastewater treatment facility. The following information is given in tabular form exemplifying some of these emergencies and responses.

TREATMENT SYSTEM CATEGORY	EMERGENCY	RESPONSE
Collection System	Line obstruction	1. Analyze situation to determine proper course of action. 2. Implement prevention measures as required – particularly mutual aid agreements. 3. Dispatch a pretrained crew properly equipped. 4. Always check spare parts inventory. 5. Provide portable lighting if at night. 6. Be prepared to cope with traffic. 7. Pump flow around trouble area utilizing portable pumps and quick coupling pipe. 8. Be prepared to cope with sewage backup into nearby buildings, especially those with basements. 9. Restore condition to normal as rapidly as possible. 10. Always clean up the area and treat with lime if spillage occurred. 11. Critique response plan.
Pumping Stations	Equipment failure	1. Analyze the situation to determine the proper course of action. 2. Implement prevention measures as required – particularly mutual aid agreements. 3. Dispatch a pretrained crew properly equipped. 4. Provide portable lighting if at night. 5. Pump flow around trouble area utilizing portable pumps. 6. Critique response plan.
	Equipment failure	1. Check spare parts inventory. 2. Use original equipment quality replacement parts. 3. Always use appropriate lifting and hoist equipment.

TREATMENT SYSTEM CATEGORY	EMERGENCY	RESPONSE
Pumping Stations (Continued)	Equipment failure (continued)	4. Check impellers for blockage due to rags and trash. 5. Check for bearing seizure due to overheating or insufficient lubrication. 6. Check for loose couplings. 7. Always lubricate before restart.
	Power loss	1. Determine if the power loss is local or area-wide. 2. If loss is local, check out all electrical circuits for shorts or system overload. 3. If the loss is area-wide, contact the power company and coordinate repair and start-up operations with them.
	Explosion	1. Determine immediately the cause of the explosion and take action to prevent additional explosions. 2. Notify the fire and police departments and the rescue squads.
Pretreatment	Clogged screens	1. Bypass the unit until the units are operating again. 2. Check cutler for dull blades and replace as required. 3. Check the capacity to be certain units are not hydraulically overloaded. 4. Manually keep the screens clean until problem is corrected. 5. Critique response plan.
Primary treatment	Stoppage of sludge collection mechanism	1. Analyze the situation to determine if repair can be made without draining the tank. 2. Check to see if rags and debris have entwined around the sludge collector mechanism. 3. Check tank bottom for excessive deposits of sand, rock, and other inorganic material.

TREATMENT SYSTEM CATEGORY	EMERGENCY	RESPONSE
Primary treatment (Continued)	Stoppage of sludge collection mechanism (Continued)	4. Stir media manually to lessen or remove accumulations. 5. If applicable, check all drives, chains, and sprockets for malfunctions. 6. Check out the electrical circuit for shorts and system overload. 7. Critique response plan.
Secondary treatment	Rapid sludge removal system malfunctioning	1. Analyze the situation to determine if repair can be made without draining the tank. 2. Open and adjust all suction ports to obtain optimum sludge removal. 3. Backwash system to eliminate clogged condition. 4. Critique response plan.
	Clogged diffuser tubes or clogged sprayer in aeration equipment	1. Replace the clogged unit as soon as possible. 2. Clean the clogged unit immediately upon removal. 3. Check air lines for dirt and trapped water or ice. 4. Critique response plan.
	Clogging and ponding of trickling filter media	1. Check the size of the filter media for nonuniformity. Replace as required. 2. Check forcementing or breaking up of media. 3. Check for fibers, slime growths, trash, insect larvae, or snails in the filter media voids. 4. Stir media manually to lessen or remove accumulations. 5. Flood the filter media for about 24 hours to loosen surface accumulations. 6. Dry growth by drying filter for several hours, if possible. 7. Jet spray areas in filter media with a high pressure water spray. 8. Critique response plan.

Summary

Note that with the previous data some specific problems were also included which for some plants may not constitute an emergency condition. However, in most instances, if these conditions were to go unattended, they would develop into an emergency. What is considered an emergency at one facility might not be classified as such at another plant because of the differences in personnel, equipment, training, and size.

Problems relating to disinfection have not been included in the previous data. This system category has been more than adequately covered in the EPA Manual entitled "Procedural Manual for Evaluating the Performance of Wastewater Treatment Plants," Contract No. 68-01-0107. If information concerning problems and emergency conditions relating to disinfection is desired, this manual should be consulted.

SECTION IX
CHECKLIST FOR O & M MANUAL
EMERGENCY OPERATING AND RESPONSE PROGRAM

In accordance with the eligibility requirements of the Environmental Protection Agency's Construction Grants Program, Wastewater Treatment Plant Operation and Maintenance (O & M) Manuals must be prepared. The following information is supplied as a checklist to assist in the preparation of the Emergency Operating and Response Program Chapter of O & M Manuals:

1. Perform a study to determine the potential for natural disaster in the area where the municipal wastewater treatment system is located. This study should result in an estimate of the severities and frequencies of occurrence for each natural disaster investigated. From the severity/frequency estimate, a priority list can be established for use in performing the various system vulnerability analyses.

2. Perform a vulnerability analysis of the treatment system. Compare the analyses results and identify the key-most vulnerable components of the system. List these key components and indicate priorities for repair. Suggest techniques to reduce vulnerability of key components.

3. Inventory the emergency equipment, materials, and chemicals available within the treatment system. This inventory should be printed in the Emergency Response Plan Section of the O & M Manual. Suggest any additional equipment/supplies that should be purchased and maintained.

4. Based on the disaster study, vulnerability analyses, and emergency inventory prepare a list of potential mutual aid agreements. This portion of the plan could contain a sample mutual aid agreement form.

5. Develop a program for the protection of essential records, maps, and inventories. A list of the documents to be protected should be prepared.

6. Prepare an inventory of all industrial contributors to the municipal treatment system. Locate each industrial discharge on a map of the collection system. Suggest monitoring equipment in collection lines if necessary. List potential hazardous materials and neutralizing chemicals. Prepare a list of key personnel at each industry. Suggest mechanism for industries to report accidental spills to treatment plant.

7. Establish a program for local fire and police departments to review periodically treatment system for adequacy of fire prevention methods and security measures. These agencies should also be made aware of any potential chlorine gas emergencies.

8. Prepare emergency response cards for all treatment system personnel. These cards outline each individual's emergency condition duties. Sample cards should be included in the O & M Manual.

9. Designate the area that is to serve as the emergency response center. List the equipment and staffing requirements for this center.

10. An important area to be covered in the Emergency Operating and Response Plan section of the manual is the procedure to be followed when reporting damages to the treatment system's insurance company.

11. Develop the requirements for auxiliary personnel to assist when conditions exceed capability of existing staff or when staff members are unable to reach their assigned emergency positions.

12. Prepare treatment process diagrams to show how units may be bypassed during emergencies and to assist in locating problem areas during emergencies.

13. Develop a program to allow the treatment system owner to critique the emergency response actions of his personnel.

14. Prepare an emergency condition matrix. This matrix should list likely emergency conditions and give response plan actions and prevention recommendations for that particular system.

15. Establish a program for training personnel in emergency operating procedures.

16. Prepare a list of local contractors and repair services. This list can be used in selecting firms from which to request assistance during emergencies.

17. Coordinate with local utility companies. Determine the probability of power failures that would affect the treatment system. List key personnel at utility companies to be contacted during emergencies.

18. Describe the failsafe alarm system that is installed at the treatment plant and at remote pumping station.

19. Establish a plan to ensure that chlorination can be provided to any potential spill of raw or inadequately treated municipal wastewater.

20. Set up a program for placing emergency standby equipment into service periodically.

21. Coordinate with the local water utility and establish priorities for repairing lines and facilities after a disaster.

22. During a major emergency, the water treatment plant and distribution system may suffer major damage resulting in very little flow of wastewater reaching the treatment facility. For this reason, careful coordination with the local water supply system is necessary, since it may well be that the waterworks restoration has priority over the wastewater treatment plant.

NOTE: For specific information related to plant O & M Manuals, the EPA Manual entitled "Considerations for Preparation of Operations and Maintenance Manuals," Contract No. 68-01-0341, should be consulted.

SECTION X
REFERENCES

1. Federal Guidelines for Design, Operation and Maintenance of Waste Water Treatment Facilities, U.S. Department of the Interior, FWQA, September, 1970.

2. Recommended Standards for Sewage Works, Great Lakes—Upper Mississippi River Board of State Sanitary Engineers, 1971 Revised Edition, Health Education Services, Albany, New York.

3. R. L. Michel, A. L. Pelmotor, and R. C. Palange, "Operation and Maintenance of Municipal Waste Treatment Facilities," *Journal WPCF* 41, 3, Part 1, 335-354 (March, 1969).

4. T. H. Gaines, "Pollution Control at a Major Oil Spill," *Journal WPCF* 43, 4, 651-67 (April, 1971).

5. S. L. Moore and S. R. Kin, "Train Wreck Causes Cyanide Pollution," *Water and Sewer Works* 116, 35 (1969).

6. Anon., "Insecticide Spill Poisons Rhine," *Eng. News—Record* 183, 1, 18 (1969).

7. Anon., "Most Serious Oil Pollution Threat Not Covered by Law," *Environmental Science and Technology* 2, 6, 400 (June, 1968).

8. Anon., "The Torrey Canyon Affair," *Environmental Science and Technology* 1, 4, 273 (April,1967).

9. Anon., "The Continuing Tale of the Torrey Canyon," *Environmental Science and Technology* 1, 5, 391 (May, 1967).

10. American Petroleum Institute, "Primer on Oil Spill Cleanup," *Environmental Science and Technology* 3, 4, 399 (April, 1969).

11. Anon., "Removing Oil From Troubled Waters," *Environmental Science and Technology* 3, 5, 417 (May, 1969).

12. Anon., "Fertilization of Oil Slicks," *Industrial Water Engineering* 7, 7, 4 (July, 1970).

13. Anon., "Inverted Weir for Oil Slicks," *Industrial Water Engineering* 7, 11, 4 (November, 1970).

14. Anon., "New Oil Skimmer," *Industrial Water Engineering* 5, 2, 33 (February, 1968).

15. S. H. Vaughn, "Removing Oil From an Industrial Waterway," *Industrial Water Engineering* 3, 11, 21 (November,1968).

16. Anon., "Combating a Chemical Spill," *Industrial Water Engineering* 5, 5, 12 (May, 1968).

17. Comptroller General of the U.S., "Operation and Maintenance of Municipal Waste Treatment Plants," Report to the Subcommittee on Air and Water Pollution of the Committee on Public Works, U.S. Senate, U.S. Government Printing Office 33-034 (November, 1969).

18. Department of the Navy, "Maintenance and Material Management (3M) Manual," OPNAV 43 P2 (October, 1969), and the 3M Documentor's Handbook, OPNAV 43 P5 (October, 1969).

19. Pollutional Effects of Stormwater and Overflows from Combined Sewer Systems, PHS Publication No. 1246, November,1964.

20. Operation of Wastewater Treatment Plants, *Journal WPCF*, Manual of Practice.

21. Wells, W. H. and Garrett, M. T., Jr., "Getting The Most From An Activated Sludge Plant," *Public Works*, Vol. 102, No. 5, May, 1971, p. 63.

22. "Reverse Osmosis System Design for Long Life and High Performance," *Public Works*, Vol. 102, No. 5, May, 1971, p. 126.

23. Gale, E. B., "What a Foreman Should Know About Constructive Discipline," The Dartnell Corp.

24. Sarsfield, A. C., "Watering Small Specialized Areas," *Grounds Maintenance*, Vol. 7, No. 6, June, 1972, p. 40.

25. Garrett, J. T., "The Anatomy Of An In-Transit Spill," *Journal WPCF*, Vol. 43, No. 5, p. 773 (May, 1971).

26. Dogue, R., "Fundamentals of Odor Control," *Journal WPCF*, Vol. 44, No. 4, p. 583 (April, 1972).

27. Eisenhauer, H. R., "Increased Rate and Efficiency of Phenolic Waste Ozonation," *Journal WPCF*, Vol. 43, No. 2, p. 200 (February, 1971).

28. Chambers, C. W., "Chlorination For Control Of Bacteria And Viruses In Treatment Plant Effluents," *Journal WPCF*, Vol. 43, No. 2, p. 228 (February, 1971).

29. Regan, J. M. and Peters, M. M., "Heavy Metals In Digesters: Failure And Cure," *Journal WPCF*, Vol. 42, No. 10, p. 1832 (October, 1970).

30. Grigoropoulos, S. G., Vedder, R. C. and Max, D. W., "Fate of Aluminum—Precipitated Phosphorous in Activated Sludge and Anaerobic Digestion," *Journal WPCF*, Vol. 43, No. 12, p. 2366 (December, 1971).

31. Swift, W. H., Touhill, C. J., Templeton, W. L., and Roseman, D. P., "Oil Spillage Prevention, Control and Restoration – State of the Art and Research Needs," *Journal WPCF*, Vol. 41, No. 3, Part 1, p. 392 (March, 1969).

32. Peterson, S. A. and Zablatzkv, H. R., "Anaerobic Digestion Failures," *Journal WPCF*, Vol. 40, No. 4, p. 581 (April, 1968).

33. McKinney, R. E., "Overloaded Oxidation Ponds – Two Case Studies," *Journal WPCF*, Vol. 40, No. 1, p. 49 (January, 1968).

34. "Anaerobic Sludge Digestion," *Journal WPCF*, Manual of Practice No. 16.

35. Santry, I. W., Jr., "Hydrogen Sulfide Odor Control Measures," *Journal WPCF*, Vol. 30, No. 3, Part 1, p. 459 (March, 1966).

36. den Otter, C. J., "A Physical Method For Permanent Control Of Psychoda Pests At Wastewater Treatment Plants," *Journal WPCF*. Vol. 38, No. 2, p. 156 (February, 1966).

37. Dunbar, O. D. and Henry, J. G. F., "Pollution Control Measures For Stormwater and Combined Sewer Overflows," *Journal WPCF*, Vol. 30, No. 1, p. 9 (January, 1966).

38. Pierce, D. M., "The Primary Sedimentation Tank – Control Center Of The Treatment Plant," *Journal WPCF*, Vol. 32, No. 9, p. 1015 (September, 1960).

39. "Emergency Planning For Water Utility Management Handbook," *Journal AWWA*, January, 1972.

40. Wedeman, J. D., "Establishing Emergency Operating Procedures For Water Systems," *Journal AWWA*, Vol. 46, No. 6, p. 514 (1954).

SECTION XI
APPENDICES

A. CONCLUSIONS FROM THE EVALUATOR'S TABULATION LIST OF EMERGENCY CONDITIONS

B. MATRIX OF EVALUATOR'S TABULATION LIST RESULTS

APPENDIX A

CONCLUSIONS FROM THE EVALUATOR'S TABULATION LIST OF EMERGENCY CONDITIONS

NOTE: A questionnaire (Evaluator's Tabulation List) was prepared, approved by the Office of Management and Budget, and mailed to over 200 municipal treatment facilities across the country. The selection of facilities was based on treatment plant type, plant size, and geographic location. All states and all major river basins were represented.

The following conclusions were drawn from information received from the questionnaire and follow-up contacts.

PRIMARY TREATMENT SYSTEMS

50 MGD and Larger

1. Facilities of this size usually have an adequate maintenance staff to handle all but the most difficult maintenance tasks. (Exceptions noted: private contractors repairing collapsed gravity lines, restoring power to remote pump stations, and assisting in repair of incineration equipment.)

2. Parts to repair pretreatment equipment (screens, comminutors, grinders, and grit collectors) frequently have to be obtained by special order. Sludge removal mechanism repairs often require special order parts.

3. Modifications are often required on some sludge handling equipment (vacuum filters and incinerators) to obtain acceptable operation. A clarification unit was also modified at one installation.

4. Emergency conditions common to all treatment systems responding include: pump station equipment breakdown; pretreatment equipment breakdown (screening, grinding, shredding); clarifier equipment breakdown; and sludge pump clogging.

10 MGD to 50 MGD

1. Facilities of this size usually have a predetermined emergency response team to handle emergencies.

2. An adequately trained maintenance staff for plants of this size can handle all but the most difficult maintenance problems.

3. Plants of this size are equipped with emergency standby equipment for most problems.

4. When parts are required, the facilities usually have them in stock or they must be obtained by special order. Special order parts are usually for the grit collection equipment, clarifier mechanism, or sludge pumps. Parts are not usually available locally.

Less Than 10 MGD

1. Facilities of this size are usually able to make repairs with parts in stock for all but major problems encountered.

2. When parts are required which are not in stock, they must be put on special order; 30 to 60 days is required for delivery.

3. Emergency conditions common to all of this size treatment facilities are obstructions and collapse in gravity lines; breakdown of grit collection equipment, pre-aeration equipment and clarifier mechanisms; and pump clogging in sludge handling equipment.

SECONDARY TREATMENT SYSTEMS WITH TRICKLING FILTERS

10 MGD to 50 MGD

1. The maintenance personnel for facilities of this size can make repairs and adjustments for all but major problems encountered.

2. Facilities of this size usually have a predetermined emergency response team to handle emergencies.

3. Repair service or private contractor will often be required to handle major problems in grit collection equipment, clarifier mechanism, trickling filter mechanism, or digestion equipment. If parts are not in stock, they must usually be obtained by special order. Parts are not usually available locally.

4. Plants of this size are usually equipped with emergency standby equipment for most problems.

Less Than 10 MGD

1. For facilities of this size, the maintenance personnel can make repairs and adjustments for all but major problems encountered.

2. Facilities of this size have automatic alarm system and emergency standby equipment to handle most problems.

3. Private contractor or repair service will often be required to handle major problems with digestion equipment and trickling filter mechanism. Often the parts required must be obtained by special order.

SECONDARY TREATMENT SYSTEMS WITH ACTIVATED SLUDGE

50 MGD and Larger

1. Facilities of this size have a predetermined emergency response team and emergency standby equipment to handle most problems.

2. Facilities maintenance personnel handle all but the most difficult problems where either a private contractor or repair service with the equipment or personnel will be required.

3. Facilities of this size have spare parts, components, or equipment to handle most emergencies.

10 MGD to 50 MGD

1. Plants of this size are equipped with emergency standby equipment for most problems.

2. Facilities of this size usually have a predetermined emergency response team to handle emergencies.

3. Facilities maintenance personnel can handle all but the most difficult problems.

4. Facilities of this size report spills to a State agency.

5. Duration of spills for treatment facilities of this size is usually less than six hours.

Less Than 10 MGD

1. The maintenance personnel can make repairs and adjustments for all but major problems encountered.

2. Private contractor or repair service will often be required to handle major problems, and, when parts are required, they must be obtained by special order.

3. Plants of this size are equipped with emergency standby equipment and alarm systems for most problems.

☆U.S. GOVERNMENT PRINTING OFFICE: 1974 546-316/278 1-3

APPENDIX B

EPA REGION I

MATRIX OF EVALUATOR'S TABULATION LIST RESULTS (MUNICIPAL WASTEWATER TREATMENT SYSTEMS RESPONDING)

State	Facility Name	Plant Size	Type Treatment	Plant Superintendent
Connecticut	New Haven Wastewater Treatment Plant New Haven	22.5 (MGD)	Primary (Mechanically cleaned tanks)	Stephen L. Lyon
	Town of Westport Sewage Treatment Plant Westport	0.57 (MGD)	Secondary (Conventional activated sludge)	Vincent J. Rotondo
	City of Groton, Connecticut Pollution Abatement Facility	3.2 (MGD)	Secondary (Conventional activated sludge)	Walter A. Steward
Maine	Pollution Abatement Facility Bangor	11 (MGD)	Primary (Mechanically cleaned tanks)	Ralph E. Mishou
	Camden Water Pollution Control Plant Camden	1.2 (MGD)	Secondary (Extended Aeration)	Frank E. Stearns
Massachusetts	Holyoke Refuse & Wastewater Disposal Plant	7 (MGD)	Primary (Mechanically cleaned tanks)	Michael J. O'Donnell
	Pittsfield Wastewater Treatment Plant Pittsfield	10 (MGD)	Secondary (Trickling and Intermittent Sand Filter)	William H. Fallon
New Hampshire	Merrimack Waste Treatment Facility Merrimack	10 (MGD)	Secondary (Activated sludge, conventional & step aeration; and high rate trickling filter	K. R. Sherwood
Vermont	Northfield Treatment Plant Northfield	3.32 (MGD)	Secondary (High rate trickling filter)	Marcel L. Herbert

EPA REGION II

MATRIX OF EVALUATOR'S TABULATION LIST RESULTS

State	Facility Name	Plant Size	Type Treatment	Plant Superintendent
New Jersey	Main Sewage Treatment Plant Camden	53 (MGD)	Primary treatment	John Frazee
	Hoboken Treatment Plant Hoboken	20.7 (MGD)	Primary (Mechanically cleaned tanks)	Charles P. Schmidt
	Trenton Sewage Treatment Plant Trenton	20 (MGD)	Secondary (High rate trickling filter)	Walter P. Simmius, Jr.
	Newark Bay Treatment Plant Newark	324 (MGD)	Primary (Mechanically cleaned tanks)	Thomas Perry
New York	Sewage Disposal Plant Poughkeepsie	10 (MGD)	Primary (Mechanically cleaned tanks)	C. O. Johnson
	Buffalo Sewer Authority Buffalo	150 (MGD)	Primary (Mechanically cleaned tanks	Anthony G. Cipriano

EPA REGION III

MATRIX OF EVALUATOR'S TABULATION LIST RESULTS

State	Facility Name	Plant Size	Type Treatment	Plant Superintendent
Virginia	Water Pollution Control Plant Richmond	70 (MGD)	Primary (Mechanically cleaned tanks)	Ben F. Gregory, Sr. (Maintenance Chief)
	Water Pollution Control Plant Petersburg	7 (MGD)	Primary (Mechanically cleaned tanks)	T. T. Musgrove, Jr.
	Water Pollution Control Plant Roanoke	21 (MGD)	Secondary (Conventional activated sludge)	H. S. Zimmerman
	Charlottesville Moores Creek	2.54 (MGD)	Secondary (High rate trickling filter)	C. G. Haney
	Meadow Creek	2.86 (MGD)	Secondary (High rate trickling filter)	
	Virginia Beach	70 pumping stations	—————	Bill McMillan (Asst. Supt. Sewers)
	Hampton Roads Sanitation District (Norfolk)			J. M. Bain (Civil Engineer)
	James River Plant	6 (MGD)	Secondary (Modified activated sludge)	
	Boat Harbor Plant	22 (MGD)	Primary	
	Army Base Plant	14 (MGD)	Primary	
	Lamberts Point Plant	29 (MGD)	Primary	
	Chesapeake—Elizabeth Plant	12 (MGD)	Secondary (Activated sludge)	
	Williamsburg	4 (MGD)	Secondary (Activated sludge)	
Pennsylvania	ALCOSAN Wastewater Treatment Plant Pittsburgh	150 (MGD)	Primary (Mechanically cleaned tanks)	Leon Wald (Executive Director)
West Virginia	Waste Treatment Plant Huntington	17 (MGD)	Primary (Mechanically cleaned tanks)	W. C. Rood
Washington, D.C.	Blue Plains Wastewater Treatment Plant Washington, D. C.	240 (MGD)	Secondary (Activated sludge)	Robert R. Perry

EPA REGION IV

MATRIX OF EVALUATOR'S TABULATION LIST RESULTS

State	Facility Name	Plant Size	Type Treatment	Plant Superintendent
Kentucky	Bromley Plant Covington	20 (MGD)	Primary (Mechanically cleaned tanks)	Robert Goebel
Alabama	Mobile			A. B. Dveitt
	McDuffie Island	16 (MGD)	Secondary (Activated sludge)	
	Three Mile Creek	10 (MGD)	Secondary (High rate trickling filter)	
	Eslava Creek	4.2 (MGD)	Secondary (High rate trickling filter)	
	Waste Treatment Plants	10 (MGD)	Secondary (Conventional activated sludge)	L. D. Parker
	Huntsville	20 (MGD)	Secondary (Step Aeration)	
		3.5 (MGD)	Secondary (High rate trickling filter)	
Florida	St. Petersburg			R. W. Leverich
	No. 1	20 (MGD)	Contact Stabilization	
	No. 2	8 (MGD)	Activated Sludge*	
	No. 3	9 (MGD)	Activated Sludge*	
	No. 4	9 (MGD)	Activated Sludge*	
			*Complete-mix	
Mississippi	Meridian	8 (MGD)	Secondary (Activated sludge*) *High rate aeration	J. L. McElroy, Jr.
South Carolina	Fairforest Wastewater Treatment Plant Spartanburg	15 (MGD)	Primary (Mechanically cleaned tanks)	C. B. Doyle
Tennessee	Central Wastewater Treatment Plant Nashville	55 (MGD)	Secondary (Activated sludge)	G. A. Johnson, PE
Tennessee	Brainerd Sewage Treatment Plant Chattanooga	3.5 (MGD)	Secondary (Conventional activated sludge)	E. O. Chism

EPA REGION V

MATRIX OF EVALUATOR'S TABULATION LIST RESULTS

State	Facility Name	Plant Size	Type Treatment	Plant Superintendent
Indiana	Liquid Waste Disposal Division Plant No. 1 Indianapolis	120 (MGD)	Secondary (Step aeration conventional activated sludge)	V. J. Jansons
	Sewage Treatment Plant Terre Haute	36 (MGD)	Secondary (Conventional activated sludge)	L. E. Floyd
Michigan	City of Ann Arbor Waste-water Treatment Plant Ann Arbor	15 (MGD)	Secondary (Activated sludge)	R. E. Sayers, Sr.
	Detroit Wastewater Treatment Plant Detroit	800 (MGD)	Primary (Mechanically cleaned tanks)	J. A. Urban, PE
Minnesota	Rochester Wastewater Treatment Works Rochester	12.5 (MGD)	Secondary (Activated sludge, step aeration and high rate trickling filter)	L. W. Leach
Ohio	Mill Creek Treatment Plant Cincinnati	120 (MGD)	Primary (Mechanically cleaned tanks)	R. C. Huddle
	Springfield Water Pollution Control Springfield	25 (MGD)	Secondary (High rate trickling filter)	R. J. Collins
Wisconsin	Jones Island Sewage Disposal Plant Milwaukee	200 (MGD)	Secondary (Conventional activated sludge)	R. D. Leary
	Madison Metropolitan Sewage District Madison	32.5 (MGD)	Secondary (Activated sludge and trickling filter	O. W. Munz

EPA REGION VI

MATRIX OF EVALUATOR'S TABULATION LIST RESULTS

State	Facility Name	Plant Size	Type Treatment	Plant Superintendent
Louisiana	Lake Charles			J. P. Donovan
	Plant "A"	12 (MGD)	Conventional-Activated sludge	
	Plant "B"	12 (MGD)	Conventional-Activated sludge	
	Plant "C"	12 (MGD)	High rate-Activated sludge	
	City of Slidell Slidell	1.6 (MGD)	Conventional-Activated sludge	J. D. Cox
		0.65 (MGD)	Secondary (High rate trickling filter)	
		0.16 (MGD)	Secondary (Extended aeration)	
New Mexico	Wastewater Treatment Plant No. 1 Las Cruces	7 (MGD)	Secondary (High rate trickling filter)	Fred Wilson
	Gallup Wastewater Plant Gallup	1.6 (MGD)	Secondary (High rate trickling filter)	C. F. Keyes
Oklahoma	Southside Treatment Plant Oklahoma City	25 (MGD)	Secondary (Standard & High rate trickling filters)	P. D. Egleston
	Disposal Plant Lawton	7 (MGD)	Secondary (Standard rate trickling filter)	Bob Woods
Texas	Corpus Christi Oso Wastewater Treatment Plant Corpus Christi	12 (MGD)	Secondary (Activated sludge)	Douglas Matthews

EPA REGION VII

MATRIX OF EVALUATOR'S TABULATION LIST RESULTS

State	Facility Name	Plant Size	Type Treatment	Plant Superintendent
Iowa	Wastewater Treatment Plant Council Bluffs	24 (MGD)	Primary (Mechanically cleaned tanks)	Warren Schrewer
	City of Des Moines Sewage Treatment Plant Des Moines	35 (MGD)	Secondary (Trickling filter)	D. P. Morrow
Kansas	Waste Treatment & Systems Hutchinson	12 (MGD)	Secondary (High rate trickling filter application to land)	J. C. Yeager
	City of Wichita Wichita	45 (MGD)	Secondary (High rate trickling filter)	V. W. Pickering
Missouri	Blue River Treatment Plant Kansas City	85 (MGD)	Primary (Mechanically cleaned tanks)	C. H. Steeby
	Rock Creek Treatment Plant Independence	5.5 (MGD)	Primary (Plain hopper bottom tanks)	R. F. Swinney
Nebraska	Water Pollution Control Plant Beatrice	5 (MGD)	Secondary (Standard rate trickling filter)	Bruce Bates
	Missouri River Plant Omaha	73 (MGD)	Primary (Mechanically cleaned tanks)	James Lofton
	Papio Creek Plant Omaha	18 (MGD)	Secondary (Activated sludge)	James Lofton

EPA REGION VIII

MATRIX OF EVALUATOR'S TABULATION LIST RESULTS

State	Facility Name	Plant Size	Type Treatment	Plant Superintendent
Colorado	Northside Treatment Plant Denver	120 (MGD)	Primary	A. E. Patterson
	City of Colorado Springs Sewage Treatment Colorado Springs	25 (MGD)	Secondary (High rate trickling filter and intermittent sand filter)	J. D. Phillips
Montana	Billings Wastewater Treatment Plant	15 (MGD)	Primary (Mechanically cleaned tanks)	J. C. Voelker
South Dakota	Wastewater Treatment Plant Sioux Falls	12 (MGD)	Secondary (Conventional activated sludge & high rate trickling filter)	D. H. Pipe
	Wastewater Treatment Plant Rapid City	13.5 (MGD)	Secondary (High rate trickling filter)	W. D. Mailloux
Wyoming	Sewage Treatment Plant Casper	5 (MGD)	Primary (Mechanically cleaned tanks)	M. J. Miller

EPA REGION IX

MATRIX OF EVALUATOR'S TABULATION LIST RESULTS

State	Facility Name	Plant Size	Type Treatment	Plant Superintendent
Arizona	City of Tucson Wastewater Treatment Plant	37 (MGD)	Secondary (Activated sludge and high rate trickling filter)	E. O. Dye
California	East Bay Municipal Utility District – Special District No. 1 Oakland	128 (MGD)	Primary (Mechanically cleaned tanks)	Glenn Davis
	City of Sacramento Wastewater Treatment Plant Sacramento	70 (MGD)	Secondary (High rate trickling filter)	Elmer Kerr
	Hyperion Treatment Plant Los Angeles	420 (MGD)	Secondary (Conventional & activated sludge)	William F. Garber (Chief Engineer)
	Wastewater Treatment Plant No. 1 Salinas	7.5 (MGD)	Secondary (High rate trickling filter	Jess Thurmond
	Orange County Sanitation Districts Fountain Valley	185 (MGD)	Secondary (High rate trickling filter)	T. A. Dunn (Director of Operations)
Hawaii	Sewage Treatment Plant Hilo	1.5 (MGD)	Primary (Mechanically cleaned tanks)	Harold Sugiyama
	Kailua Sewage Treatment Plant Kailua	7.0 (MGD)	Secondary (High rate trickling filter)	Howard Cue
	Kaneohe Sewage Treatment Plant Kaneohe	4.5 (MGD)	Secondary (High rate trickling filter)	C. W. Houghtailing
Nevada	Wastewater Treatment Plant Las Vegas	30 (MGD)	Secondary (High rate trickling filter)	L. A. Anton
	Clark County Sanitation District No. 1 Las Vegas	12 (MGD)	Secondary (High rate trickling filter)	J. H. Parrott

EPA REGION X

MATRIX OF EVALUATOR'S TABULATION LIST RESULTS

State	Facility Name	Plant Size	Type Treatment	Plant Superintendent
Alaska	Fairbanks Sewage Treatment Plant Fairbanks	2.2 (MGD)	Primary (Mechanically cleaned tanks)	John Dirkx
Idaho	Treatment Plant Idaho Falls	10 (MGD)	Primary (Mechanically cleaned & plain hopper bottom tanks)	D. M. Clark
	Sewage Plant Boise	11 (MGD)	Secondary (Extended aeration)	H. B. Hester
	Wastewater Treatment Plant Caldwell	9.5 (MGD)	Secondary (High rate trickling filter)	G. D. Hollis
	Wastewater Treatment Plant Moscow	3.5 (MGD)	Secondary (Trickling filter)	Orrin Crooks
	Twin Falls Sewage Treatment Plant Twin Falls	12 (MGD)	Primary (Mechanically cleaned tanks)	Earl Fulmer
	Nampa Wastewater Treatment Plant Nampa	18 (MGD)	Secondary (Conventional activated sludge & high rate trickling filter)	C. L. Simpson
Oregon	Columbia Treatment Plant Portland	100 (MGD)	Primary (Mechanically cleaned tanks)	H. H. Harris
	Corvallis Wastewater Treatment Plant Corvallis	15 (MGD)	Secondary (High rate trickling filter)	J. T. Easley
Washington	Yakima	30 (MGD)	Secondary (High rate trickling filter)	P. L. Page
	Walla Walla	10 (MGD)	Secondary (High rate & standard rate trickling filters)	E. W. Anderson
	City of Olympia Sewage Treatment Plant Olympia	6.5 (MGD)	Primary (Mechanically cleaned tanks)	L. A. Esteb, Jr.
	Central Treatment Plant Tacoma	25 (MGD)	Primary (Mechanically cleaned tanks	L. W. Ketcham