OPERATIONS OVERVIEW

PURPOSE OF THE TREATMENT PLANT

The Moundsville WWTP has been designed to protect the waters of the Ohio River from direct raw sewage discharges. To accomplish this, the treatment process provides preliminary, primary, secondary and final treatment of the raw sewage from the Moundsville/Glen Dale area. The plant processes an average flow capacity of 1.25 million gallons per day <mgd) to 2.34 mgd. Plant components consist of a septage receiving facility, an inclined screw pump lift station, mechanical screenings removal, grit removal and processing, primary clarification, activated sludge system, secondary clarification, ultraviolet disinfection, standby power generation, anaerobic digestion, belt press dewatering, and existing building modifications.

WASTEWATER CHARACTERISTICS

The wastewater produced within the Moundsville-Glen Dale area consists primarily of domestic (household) wastes. A portion of the wastewater contains commercial (motels, restaurants, car washes, etc.) and industrial wastes. The City of Moundsville has combined sewers and experiences high peak flow rates. Large quantities of grit are flushed through these sewers in the spring from the cinders spread on the streets during the winter.

The Moundsville WWTP design flow rates are shown in Table 1-1.

TABLE 1-1 ANTICIPATED FLOW RATES

Design Flows	(mgd)
Minimum Day	1.0
Average Day	2.3
Peak Day	8.0

Raw sewage reaching the Moundsville WWTP is expected to have an average BODS concentration of 200 mg/L and an average TSS concentration of 225 mg/L. Table 1-2 shows the expected average BODS and TSS in units of pounds per day (lb/day), assuming an average influent flow rate of 2.3 mgd.

TABLE 1-2 ANTICIPATED BOD AND TSS LOADINGS

	BOD lb/day	TSS lb/day	
Average	3,900	4,400	*Based on 2.3 mgd

GENERAL FACILITIES DESCRIPTION

The following sections contains process descriptions and purposes for each unit process at the Moundsville WWTP. The discussion follows the treatment process from preliminary treatment through final treatment, and includes discussions on solids processing facilities. The purpose of this section is to provide an overview of the treatment system in order to give the plant operators a starting point for understanding the treatment process and its objectives. Figure 1-1 is a site plan showing the physical layout of the treatment plant. Figure 1-2 is a basic plant flow schematic showing major liquid and solid flow streams and the interrelationship between unit processes at the plant.

PRELIMINARY TREATMENT

Preliminary treatment essentially prepares the wastewater for further treatment by the primary and secondary treatment systems. The most important aspect of preliminary treatment is the protection of downstream equipment and systems. Preliminary treatment at this plant includes an influent sewer lift station, interceptor junction manhole at the head end of the plant, odor control injection at the junction manhole, raw sewage pumping, screening and grit removal. The preliminary treatment system also includes a septage receiving facility for collection of waste sludge from septic tanks in the Moundsville/Glen Dale area. Descriptions of the facilities included in the preliminary treatment system follow.

Septage Receiving Facility

The septage receiving facility accepts wastes from commercial septic tank pampers and blends them into the treatment plant flow stream. Septage that is received in this manner is stored, pretreated if necessary, and then pumped to the anaerobic_ digesters.

The septage receiving facility is located next to the bar screen area. It is a 1,600 gallon covered concrete holding tank with duplex grinder pumps on guide rails for pumping of the contents to the digester.

Junction Manhole

The existing junction manhole is located on the west side of the main access road into the plant site just inside the main gate. An existing 36 inch sewer and a new 16 inch sewer enter this manhole. An existing 36 inch sewer leaves this structure and is routed to the wet well. A sluice gate has been provided on the effluent 36 inch line to isolate the wet well from incoming flows. A valve has been installed on the 16 inch sewer to isolate the junction manhole from incoming flows from this line. No isolation of the influent 36 inch line has been provided in the structure;

Screening System

The purpose of the screening system is to remove coarse debris, such as sticks and rags, that are often present in the raw wastewater entering a wastewater treatment plant. Removal of this material helps prevent clogged pipes and valves and minimizes potential damage to downstream equipment.

The screening system consists of two mechanically cleaned bar screens, a screening can and an electric hoist for the screenings can. The screening system is located at the north end of the standby generator/workshop area.

Raw Wastewater Pumping System

The raw wastewater pumps lift the plant influent from the influent wet well to the channel in the aerated grit chamber. This allows the wastewater to flow by gravity through the rest of the plant to Grave Creek at its confluence with the Ohio River.

The raw wastewater pumping system consists of four horizontal centrifugal sewage pumps, a variable frequency drive (VFD) control system, and an influent wet well. The pumps are located in the basement of the Administration Building.

Grit Removal System

Grit consists of gravel, sand, mineral matter, and nondegradable organic material such as coffee grounds, fruit rinds, and seeds. It is important to remove this debris for a number of reasons, including the following:

- o To protect moving mechanical equipment from abrasion and abnormal wear.
- o To prevent formation of large deposits of grit in downstream pipes, valves, conduits and channels.
- o To prevent loading the treatment process units with inert matter that might interfere with their operation, such as excessive grit accumulation in a digester that would reduce its usable capacity.

The grit removal system consists of one aerated grit chamber, one cyclone separator grit washer unit, one grit slurry pump and a grit storage hopper. The grit washer unit and hopper are located in the Dewatering Building. The grit pump is located adjacent to the aerated grit chamber. The washed grit is stored in a hopper over the Solids Loading Area for periodic removal by a truck.

Flow Measurement

The influent wastewater flow rate to the treatment plant is measured for several reasons:

- o To meet operating and discharge requirements set by federal, state and local governments.
- o To operate certain metering processes based on flow, o To determine the efficiency of various unit processes.
- o To make sure that various processes are operating within their capacity.
- o To determine required process modifications.

Influent flow measurement at the plant is done by an ultrasonic flow meter located on the 16 inch discharge line downstream of the four raw wastewater pumps. A transmitter/receiver probe is mounted on the 16 inch line and an ultrasonic signal is sent across the interior of the pipe. The signal bounces off the opposite side of the pipe and returns to the probe. Flow rate and totalized flow is measured automatically and flow is recorded on a 24-hour strip chart recorder in the standby generator/workshop area in the motor control center.

PRIMARY TREATMENT

The purpose of primary treatment is to remove most of the settleable solids, and to remove all readily floatable material in the wastewater plant influent. This is accomplished in primary clarifier basins. The velocity of the wastewater flow is slowed enough in these basins to allow the settleable material to separate from the flow. These solids settle on the bottom of these clarifier basins and are collected by mechanical collectors. The primary sludge is pumped from the primary clarifiers to the anaerobic digesters. Floating solids are removed by mechanical skimmers and are deposited in scum pits located at each clarifier. These solids are then pumped to the anaerobic digesters.

Primary Clarifiers

There are two primary clarifiers in operation at this plant. The clarifier basins are circular, with a 60 foot diameter and a 10-1/2 foot sidewall water depth.

Flow enters the center of these clarifiers and as it passes to the outside collection launder, the heavier solids settle to the floor of the clarifier to form primary sludge. The clarified effluent flows over a V-notched weir plate at the outside of the clarifier basin walls and is collected in an effluent trough or "launder".

A rotating rake arm continually sweeps the floor of these basins to move the primary sludge that continually collects to the center of the clarifier. At this point, the sludge enters a sludge hopper and flows by gravity to the primary sludge pump room in the Administration Building. From there it is pumped directly to the anaerobic digesters.

Scum collected on the surface of these basins is moved by a scum collecting arm (connected to the sludge rake) to a scum beach and trough. From there it flows by gravity to a scum pit. A pump at each scum pit pumps the collected primary scum to the anaerobic digesters.

SECONDARY TREATMENT

Secondary treatment is intended to reduce the concentration of pollutants contained in the primary effluent so the plant effluent will meet U. S. EPA and West Virginia Department of Natural Resources' requirements for discharge to the Ohio River.

This phase of the treatment process includes the Captor basins, activated sludge basins, secondary clarification, sludge recycling, sludge wasting, and sludge thickening.

Captor System

The Captor system, which is the secondary treatment system at this plant, consists of Captor pad basins followed by an activated sludge system. This results in an "attached-growth" biological population being followed by a "suspended-growth" biological population. Fixed-growth biological populations (slime) are directly attached to the Captor pads, while suspended-growth populations (mixed liquor) are produced and maintained in the activated sludge process.

The goal of this and any other biological treatment system is to convert all of the soluble BOD to bacterial cells or biomass which form natural sludge floes in the complete mix basins. These floes then entrap all of the particulate and colloidal BOD in the wastewater where it is converted to additional cell mass.

Captor Basins

There are two Captor basins followed by two aeration basins. Primary effluent flows by gravity into an influent channel where it is evenly distributed by ports into the two Captor pad basins. Each pad basin contains a pre-pad, high intensity mixing zone with no pads, a pad zone completely filled with pads, and a post-pad, high intensity mixing zone with no pads. Two airlift pumps recirculate flow from the post-pad mixing zone to the pre-pad mixing zone to maintain a uniform hydraulic loading rate through the pad zone. Aeration diffusers are evenly spaced throughout the three zones. Diffusers are the fine-bubble ceramic plate type.

Pads completely fill the pad zone when the basin is full of water. Wastewater flow passes laterally through this zone. No fluidization of the pads occurs. This configuration acts like a horizontal trickling filter with the recirculated flow similar to maintaining the wetting rate of a conventional vertical trickling filter. The Captor basins act as "roughing filters", assimilating a portion of the organics in the wastewater.

Sludge is "wasted" from the Captor basins (pad zone) by a submersible vortex centrifugal pumps. Pads are routinely pumped to a pad squeezer where the pads are squeezed and excess biomass is removed from the pads. The cleaned pads are returned to the pad zone by a sluice channel and the removed biomass (sludge) is dumped into a gravity thickener below the squeezer. Each pad squeezer is located in a building at the south or influent end of each Captor unit.

Aeration Basins

The aeration basins following the Captor basins further treat the wastewater, allowing biological treatment to continue in the suspended-growth mode. These basins are integral with the Captor basins. Aeration diffusers are evenly spaced throughout these basins. The diffusers are similar to those in the Captor basin. Diffuser density on the basin floor is about one-half that of the Captor basins. The suspended-growth system, capable of producing a better quality effluent than the fixed-growth system through the bio-flocculation and entrapment phenomenon, is intended to bring the plant effluent into compliance with discharge permit requirements.

Secondary Clarifiers

Secondary clarification allows the biological solids in the mixed liquor from the aeration basins to settle to the bottom of the clarifier. Secondary clarification is the final step for removing solids and organic material from the wastewater before it is disinfected and discharged to the Ohio River.

There are two secondary clarifiers in operation at this plant. Mixed liquor enters each clarifier at the center and flows upward through a center column. Near the top of the column, below the return sludge collection well, openings allow the mixed liquor to enter a central stilling well. The mixed liquor then moves downward and outward from the influent well. As the flow passes outward, the biological solids in the mixed liquor settle to the floor of the clarifier to form return activated sludge (RAS). The clarified effluent flows over a V-notched weir plate at the outside of the clarifier basin and is collected in an effluent trough or "launder".

In each clarifier, two rotating rake arms sweep the floor of the clarifier. Each rotating rake arm is equipped with several sludge suction pipes and squeegees which move the sludge toward each sludge suction pipe. The sludge from each sludge collection pipe flows into a common sludge collection well and down through a pipe that is mounted inside of the influent pipe or center column. The RAS then flows by gravity in piping to the suction side of the RAS pumps in the secondary pump room. A sludge hopper in the bottom of each clarifier allows the heavier sludge to collect. A suction from each hopper to the WAS pumps allow period removal or "wasting" of sludge from the system.

Each clarifier has a 12 foot sidewall water depth and a 65 foot diameter. The effluent launder for each unit is constructed on the inside of the clarifier walls. This arrangement is referred to as an inboard effluent launder.

Sludge Recycling and Wasting

The RAS solids removed in the secondary clarifiers must be continuously recycled *to* the upstream end of the aeration basins to combine with the Captor basin effluent and form mixed liquor. These solids are returned by the RAS pumping system which consists of two RAS pumps and two VFD's. Each pump will handle the complete RAS flow requirements of the fully operational plant. Each pump is variable speed. Each pump will continuously pump RAS at an operator-selected flow rate based on a percentage of the plant influent flow rate.

Since the micro-organisms in the Captor system are growing in the Captor pad basins and the aeration basins, it is necessary to remove some of the biomass from the system on a regular basis to maintain a constant number of micro-organisms, or quantity of activated sludge, in the system. The purpose of the waste activated sludge (WAS) pumping system is to withdraw a small portion of activated sludge from the settled sludge in the clarifier on a continuous basis, to control the amount of activated sludge in the system. The WAS pumping system sends the wasted sludge to the gravity thickener units of the head end of the Captor basins or to the influent into the primary clarifiers where it can be removed with the primary sludge.

FINAL TREATMENT

The final treatment portion of the plant includes ultraviolet disinfection and effluent post aeration. It is the final stage in the treatment process prior to discharge to the Ohio River.

Ultraviolet Radiation

The primary purpose of the ultraviolet radiation system is to disinfect the secondary effluent (SE) by exposing the flow to ultraviolet radiation before it is discharged from the plant to the Ohio River. Disinfection is necessary to satisfy the discharge requirements for bacteriological quality. (Ultraviolet radiation (UV) disinfects by transferring the electromagnetic energy from the UV lamps to the bacterial genetic material. The effect is that the bacterial cell cannot replicate and the bacterial population entering the receiving stream dies off rapidly thus preventing the transmission of water-borne disease.

Two banks of UV lamps are installed in removable racks in a channel situated on the east side of the secondary pump room. Effluent from the two secondary clarifiers is routed to this channel. Control panels for the ultraviolet lamps are located above the channel on the roof of the secondary pump room. Following radiation by the UV lamps, the effluent is routed through a 30 inch effluent line to the cascade structure.

Cascade Structure

The cascade structure is located on the north bank of Grave Creek just south of the primary anaerobic digester. Its purpose is to provide post aeration to the secondary effluent to meet the discharge permit requirements. Aeration is accomplished through the free energy supplied by the elevation difference of the outfall line and the pool elevation of Grave Creek/Ohio River. The effluent cascades down 12 steps to incorporate sufficient oxygen into the water for the design conditions.

SLUDGE HANDLING

Sludge handling consists of gravity thickening of Captor pad sludge and waste activated sludge (WAS), anaerobic digestion, and belt filter press dewatering. Gravity thickening increases solids concentrations in the waste activated sludge and the Captor pad sludge which reduces the volume of sludge requiring treatment. Concentrated solids are treated anaerobically to eliminate offensive odors, reduce concentrations of pathogenic organisms, stabilize the sludge to prevent putrefaction, and to further reduce the volume of solids to handle. When sludge digestion is complete, the sludge is ready for dewatering on the belt filter presses and for ultimate disposal.

Gravity Thickening

The gravity thickening process is similar to primary clarification. The purpose of this process is to increase the solids concentration of the combined Captor pad sludge and waste activated sludge, thereby reducing its volume.

There are two gravity thickener basins at the influent end of the Captor basins. Each basin slopes to a hopper bottom with a sludge drawoff line. A decant screen with a decant drain line is located at one end of the basin to allow the decanting of liquid from the collected sludge. Waste activated sludge is pumped into the basin and the Captor pad sludge is dumped into the basin from the pad squeezer located above. Sludge removal is controlled by two progressing cavity pumps with timers.

Each gravity thickener has an overall area of 6 ft. by 12 ft. and a depth to the bottom of the hopper of 17 feet. Captor pad sludge enters the tank with an average of 2 percent solids. Waste activated sludge enters the tank with an average of one percent solids. It is anticipated that the combined sludge will thicken to 3 to 4 percent solids at the bottom of the basin.

Anaerobic Digestion

The purpose of anaerobic digestion is to change the primary sludge, WAS and Captor pad sludge, into a relatively stable and dewaterable end product. Anaerobic digestion stabilizes the volatile solids in the sludge (reduces the food value to micro-organisms), reduces mass, odor, and pathogenic organisms, and conditions the sludge for easier dewatering. In addition, methane gas is produced that can be used to heat the digesters.

Anaerobic digestion occurs in three basic steps, and it involves two different types of bacteria: The "acid formers" and the "methane formers". The three basic steps are hydrolysis, acid formation, and methane formation. The term "anaerobic" means that the digestion process occurs without oxygen. Sludge that is fed to the digester is considered food. This food, or complex organic matter, is broken down (hydrolyzed) into simpler forms that can be used as a food source by the "acid formers".

Hydrolysis is carried out by enzymes produced by the "acid formers". The simpler forms of organic matter produced by hydrolysis are then converted by the "acid formers" to carbon dioxide and organic acids.

The "methane formers" further convert the volatile acids to methane and carbon dioxide. In addition, a portion of the carbon dioxide produced is also converted to methane. The methane gas produced is used for heating the digester contents to maintain an acceptable environment for the organisms involved in the digestion process.

The anaerobic digestion system consists of the following units: primary-fixed cover digester, mechanical mix system, heating system, gas handling system, and secondary-floating cover digester.

Primary-Fixed Cover Digester

This new digester is 50 feet in diameter with an approximate SWD of 22 feet. This digester receives the thickened sludge and the primary sludge where it is mixed with the tank contents. Gas produced by the process is collected between the liquid level and the fixed cover. When the gas pressure builds up to a predetermined value, the gas is transferred to the secondary digester floating cover for storage.

The tank contents are mixed by a pump which completely turns the contents of the digester over in approximately two hours. A portion of the contents of the tank are pumped through the heating system to maintain a specific temperature range in the digester.

Mechanical Mix System

The mechanical mix system for the primary and secondary digesters consists of two axial flow pumps, piping, and the digester center columns. Digester contents overflow into a center column in the digester. The overflow is piped to the suction side of the mixing pumps. The pumps discharge the contents through a high velocity nozzle into the tank in a tangential direction. The effect is to create a vortex flow mixing pattern. Mixing time is determined by the operator to maintain the digestion process.

Heating System

The digester contents must be maintained at a temperature of 95 degrees F for the mesophilic digestion of the sludge. This is accomplished by the heating system which consists of two recirculated sludge pumps, a spiral heat exchanger, a digester gas fired boiler, and a natural gas fired boiler. By timers and thermostats, a portion of each digester's contents is recirculated through the spiral heat exchanger where hot water exchanges heat to the sludge. The digester gas fired boiler would normally be used to supply heat to the sludge. It would draw gas from the gas handling system. If additional heat is required, the control system calls for the natural gas boiler to fire.

Gas Handling System

The gas handling system consists of gas piping, a gas flow meter, various gas safety valves, and a waste gas burner. The purpose of this system is to convey gas from the fixed cover to the floating (storage) cover and to convey gas to the boiler and the waste gas burner. Stored gas is taken out of the system by burning the gas in the digester gas fired boiler to supply heating water for the digestion process or by burning it at the waste gas burner. During the winter, the majority of the gas will be consumed by the boiler for heating. During the summer, most of the gas will be burned at the waste gas burner.

Secondary-Floating Cover Digester

The secondary digester is the existing 60 foot diameter digester. The minimum and maximum SWD's are 15 and 20 feet, respectively. This means that there is 5 feet of effective gas storage volume when the floating cover is fully extended. This cover sets the system gas pressure and determines the gas flow rate to the boiler or the waste gas burner.

Digester Control Building

This building is situated between the two digesters. It houses the gas handling system, the mechanical mix pumps, piping, the heating system, and all control features of these systems.

Belt Filter Press Dewatering

Each belt filter press dewatering system consists of a belt press, a polymer mix unit, and a variable speed digested sludge transfer pump. Each system is designed to handle 100% of the design sludge flow rate for the plant. There are two systems in the plant. The belt presses and the polymer units are located in the Dewatering Building and the digested sludge transfer pumps and variable frequency drive units are located in the Digester Control Building.

Belt Presses

Each press is the gravity, wedge and pressure zone type with a 1.5 meter belt. Each unit has a main control panel on the wall of the building and a remove panel located on the top of the unit. A mobile ladder sits in between the two presses to allow the operator to view the condition of the sludge entering the gravity dewatering zone.

The control panels, remote or main, allow the operator to adjust belt press speed, polymer solution pumping rate, and digested sludge pumping rate. This is customarily done with the remote panel while the operator views the sludge entering the gravity zone and the sludge cake dumping onto the conveyer.

The principle of the belt filter press operation is as follows: Digested sludge is pumped through piping to a distribution pan at the front of the gravity dewatering zone of the press. Polymer solution is injected into the sludge flow stream in a static mixing device prior to the belt press. The sludge and polymer are mixed and pumped to the distribution pan. The polymer, a cationic type, acts to destabilize the charge potential of the sludge particles and make them stick together forming sludge floes. Water is liberated from the mixture when this destabilization occurs and drains through the belt into a collection pan. The flocculated sludge is conveyed to the pressure zone of the press.

In the pressure zone, the sludge is squeezed between two belts by a series of different diameter rollers. Additional dewatering occurs in this zone. A third wedge zone further compresses the formed sludge cake and releases additional water.

After the wedge zone, the sludge, which is firmly adhered to the belt fabric, contacts a scraper which peels the sludge cake off the belt fabric, forcing it to fall onto a conveyor belt. This belt will deliver the cake to a 20 yard dumpster, which will be taken to a local landfill.

Polymer Mix Unit

Each polymer mix unit is a batch mix type system. Neat polymer (polymer that is supplied in a concentrated form in a drum) is pumped by the unit into a flash mix chamber where water is introduced and a propeller mixer violently agitates the mixture. A polymer solution is formed which is pumped by the unit to the sludge static mixer located in the influent piping to the belt presses.

Digested Sludge Pumping System

Two progressing cavity pumps are provided in the digester control building to pump the digested sludge from the secondary digester to the belt filter presses in the dewatering building. Each pump is sized for 100 percent of the design digested sludge flow rate. Two variable frequency drives are located adjacent to these pumps to control the pumping rate. The remote control panel for the presses is configured to allow the operator to vary the pumping rate while viewing the sludge/polymer mixture on top of the presses.

TREATMENT PLANT UTILITIES

Various utilities at the plant provide support to the treatment process and general plant operations. These utilities, most of which are vital to plant operations, are discussed in detail in Chapter 8 and are summarized briefly below.

Drains and Sanitary Sewers

A combination of sump pump systems and gravity drains convey sanitary wastes and process wastewaters produced at the treatment plant through a network of sewers and manholes to the primary lift station wet well or the bar screen influent channel. These wastes are then treated with the raw sewage entering the plant.

Potable Water System

A potable water system provides water for domestic uses, i.e., sinks, toilets, showers, laboratory uses, a fire hydrant adjacent to the digesters, and the like. Water is provided from the City's general potable water distribution system through a 6-inch line. The potable system provides water to the nonpotable water system. Total water flow to the plant from the City's system is metered by an existing 4" meter located in the standby generator area.

Nonpotable Water System

The nonpotable water system is connected to the potable water system through a backflow preventer located in the standby generator area. This system provides service water for washdown, flushing, pump seals, and numerous other uses.

Electrical System

The plant's electrical power is supplied by American Electric Power Company. The power company's service is reduced to 480 volts through a utility-owned transformer. The 480-volt power is distributed to motor control centers throughout the plant through buried, concrete-encased duct banks.

Standby power at the plant is provided by one standby diesel generator located in the standby generator/workshop room and can provide up to 206 kw of emergency power to motor control center B which provides power to the preliminary and primary treatment facilities. The generator will start automatically if a power failure occurs in the utility-supplied power source.

Fuel System

Natural gas is supplied to the plant for the existing boiler, new hot water heater and laboratory in the Administration Building, backup boiler in the Digester Control Building, and the waste gas burner pilot.

Heating, Ventilating, Air Conditioning System

The HVAC system provides air flow, heated and cooled, to the occupiable building spaces and heat to the anaerobic digestion process. This system consists principally of boilers, natural gas and sewage gas fired, ventilators, air conditioners, hot water space heaters and hot water convectors.

Drains and Sanitary Sewers

A combination of sump pump systems and gravity drains convey sanitary wastes and process wastewaters produced at the treatment plant through a network of sewers and manholes to the primary lift station wet well or the bar screen influent channel. These wastes are then treated with the raw sewage entering the plant.

GENERAL OPERATING FUNCTIONS

The following section discusses some of the major areas of concern in operation of the Moundsville WWTP. The areas discussed include:

- Laboratory Operation
- Process Control
- Safety
- Maintenance
- Records
- Emergency Planning

The purpose of this section is to explain and tie together each of these areas, showing the interrelationships between the various departments and functions of the treatment plant. This is important for smooth and successful operation of a safe and efficient treatment process.

LABORATORY OPERATIONS

The laboratory is an integral part of the control and operation of an effective wastewater treatment facility. Effective plant operation and process control is based for the most part on accurate laboratory analysis of samples representative of various processes in the plant. Therefore, an effective laboratory must use representative samples as well as accurate laboratory analysis to ensure that proper information is available for process control.

In many instances laboratory sampling is the responsibility of the operations personnel rather than the laboratory technician. It is of utmost importance that the individual or individuals collecting the samples be aware of proper sampling locations and sampling techniques so that the final results of the laboratory analysis truly represent what is taking place in the treatment process.

To facilitate accurate sampling and laboratory analysis, the laboratory must be maintained in a clean, safe, and organized condition. This is the responsibility of all individuals using the laboratory facilities and must be stressed by the laboratory technician and the plant management staff.

PROCESS CONTROL

Process control involves interpreting data concerning plant processes and systems and subsequently making adjustments to plant operations to maintain an acceptable effluent quality.

Process control involves not only the operations and laboratory personnel but also the maintenance department. It is vital that all three parties work together to provide the necessary equipment, monitoring, and analysis required for an efficient operation.

MAINTENANCE

The goal of the Moundsville WWTP is to produce a quality effluent in a safe, organized, and economical manner. Responsibility for maintaining this goal falls on all departments within the treatment plant. Communication and organization between departments is vital to prevent complications in the treatment process that can create accidents or cause deterioration of effluent quality.

The preventative maintenance program assists the plant personnel in organizing and maintaining a maintenance program. Preventative maintenance tasks are performed on a regular basis. Corrective maintenance is performed and recorded, and the information is used for decisions concerning replacement of equipment or modifications to the treatment system. In addition, the preventative maintenance program ensures that spare parts are available to prevent prolonged equipment down time.

Responsibility for the maintenance program lies mainly with the maintenance department. However, a strong coordination between management and all other departments is required for ' successful operation of the program. A properly run maintenance program results in reduced costs, increased safety, and increased treatment efficiency. This produces a more harmonious operation and reduces the frustrations involved with operating a deficient system.

SAFETY

The goal of the safety program is to provide a safe, enjoyable working atmosphere for all employees by creating and maintaining safety awareness. The benefits of the program include reduced personnel injuries and reduced costs for both the employee and employer.

Safety awareness is important to all areas of the treatment plant; therefore, involvement is required by all departments. To maintain safety awareness, meetings should be held for setting safety policies and procedures, discussing possible safety hazards, and assigning safety related projects for completion. To supplement this, safety training classes should be held on a regular basis.

RECORDS

Accurate and readily accessible records are necessary for locating and solving operational problems. These records comprise the only proof of performance and serve to justify decisions, expenditures, and recommendations. They provide valuable information for release to customers and the public. They are also crucial documents in the event of any legal action, and they provide necessary information for plant expansions and additions.

The important records that must be kept include:

- o Daily operating log
- o Monthly reports—NPDES Permit Report
- o Annual report
- o Maintenance Records
- o Laboratory Records
- o Operating and Maintenance Costs and Personnel Records
- o Emergency condition records

A discussion of each of these records follows.

Daily Operating Log

A daily operating log should be maintained. This log should be bound in permanent notebooks to prevent destruction or alteration. The information contained in this log should include:

- o Routine operational duties, meter readings, base pump selections, elapsed time, flow, etc.
- o Unusual conditions. Accident

reports

The information contained in this log provides a basis for the monthly submittals to the West Virginia Department of Natural Resources.

Monthly Reports—NPDES Permit Report

The form for the monthly report to the state may be obtained from the West Virginia Department of Natural Resources at the address shown below. Information for completing this report is obtained from daily operations logs and laboratory records.

Department of Natural Resources Division of
Water Resources Charleston, WV 25305

Annual Reports

An annual report should be prepared by the operations and maintenance staff for the management. Sources of information for the annual report include:

- o Daily/weekly operating logs
- o Corrective and preventative maintenance work order forms
- o Monthly reports
- o Personnel time charges
- o Purchase requisitions during the period
- o Accident reports
- o Contract maintenance billings and payments record
- o Utility billings and payment records
- o Storeroom records

The purpose of this report is to advise the management and regulatory agencies about the overall performance of the treatment plant.

It is also recommended that the plant management construct an overall annual report that can assist in annual budget preparation. The contents of this report should include:

- o Operations and maintenance costs for the year
- o Needs for capital, and operations and maintenance funds for the next year
- o Major breakdowns and deficiencies in the plant
- o Safety issues—include summary of any accidents that may have occurred
- o Notable changes in influent flow and characteristics as it may affect planning for future facilities
- o Notable suggestions from operations and maintenance experience so that future designs can be improved
- o Identify operator training needs and areas of emphasis in the training program

Maintenance at the Moundsville WWTP is incorporated into a micro-computer-based maintenance system. This system has two basic functions: (1) provide a systematic preventative maintenance scheduling program; and (2) record data for each piece of equipment and maintain a history of the maintenance performed on a specific piece of equipment, as well as cost information related to that maintenance.

Laboratory Records

Laboratory records are important for daily plant operation as well as for future reference regarding plant operating performance and decisions on modifications or improvements to the plant. Examples of laboratory work sheets and records may be found in Appendix A (located with Chapter 9).

Operating and Maintenance Costs and Personnel Records

Historical data on the dollars spent for operating and maintaining the plant are very valuable. There are four basic categories of expenditures as follows:

- Personnel time charges in operating and maintaining the facility, including safety and training costs
- Utility charges—electrical, natural gas, telephone, and water
- Materials and supplies—oxygen, chemicals, tools, parts, lubricants, etc.
- Contract maintenance and repair charges

Accurate record keeping for the above categories of costs can assist the management in several ways.

- It can help track budgets versus expenditures so that mid-term corrections can be implemented.
- It assists in planning for future budget preparation processes.

Emergency Conditions Records

A record of emergency conditions affecting the Moundsville WWTP should be maintained. This record should contain reports of power failure, flooding, mechanical failures, and any other unusual operating situations.

EMERGENCY OPERATING PROCEDURES

With the necessity for protecting the environment, it is important that wastewater treatment facilities develop a well thought-out and organized system for coping with operational emergencies. Quick responses to system failures may avert substantial detrimental effects to the health and environment of the area.

The most important task of the plant operators during emergencies is to protect the health and safety of plant personnel and the general public, and to protect the quality of the Ohio River.