

STARTING NEW SEWAGE TREATMENT PLANTS

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SUCCESSFUL operation depends on effective operation. Starting sewage treatment plants may be rephrased—building and supporting an effective operating staff.

By the time a sewage treatment plant is ready to be placed in operation, very little can be done to change structures and equipment, such as pumps, tanks, instruments, digesters, and filters. The plant has been engineered, designed and constructed. The designers have done their utmost to produce the best and most flexible plant. Major changes are usually unnecessary and almost always impractical. However, regardless of the design, when a sewage treatment plant is ready for operation, the operating staff is the only variable. Operating success depends on the operating staff—the operators, the maintenance men and their supervision.

Starting may be divided into three stages:

1. The first stage begins with the preliminary report and continues through design and construction. It involves obtaining and holding the support of the municipal officials and the citizens for the sewage treatment plant and its effective operation.
2. The second stage "Initial Operation" starts about a month before actual start-up and continues for hours or weeks after sewage actually enters the plant. Training the operating staff is the chief function of this stage although holding the support of the municipal officials is still very important.
3. The third stage consists of "Refining Operation." While this continues for as long as the plant operates, we will for present discussion limit it to approximately a year after operations begin.

Without official and public support, the best sewage treatment

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plant and the most promising operating staff will be tangled in a morass which will soon produce unsatisfactory operation.

This support should have been building up as the preliminary reports were written and submitted and as the plant was being designed and constructed. In order for the sewage treatment plant to be designed and constructed, the municipal officials and voters must have been convinced of its importance. Care must be taken not to oversell the benefits to be produced by this treatment plant in the preliminary report and design stage. With operation about ready to begin, the engineer should be able to confirm the benefits which were promised in the preliminary report and by the designers. At this stage, it would be unfortunate to have to eliminate benefits which were used to sell bonds and obtain initial support for the project.

Starting a sewage treatment plant coincides with another very important event. The public officials and the taxpayers will see what their money and support has produced.

Every one is interested in publicity for the sewage treatment plant as operations start. The public officials should and usually want to arrange the publicity. They must be guided in three general areas.

1. Type of treatment, amount of purification of the sewage and benefits to the receiving waters.
2. When normal purification of the sewage and improvements of the polluted waters will occur.
3. The reasons for the time required to obtain normal purification and to improve the polluted waters and problems which may occur before normal purification is established. The potential problems are not usually publicized but must be known to the municipal officials.

Obviously, the treatment plant was designed to eliminate pollution. The responsible municipal official must know each step in the treatment process and what each will accomplish. He must have this information in a form which will be readily understood by newspaper reporters and the taxpayers. "Primary treatment will remove 40 tons per day of impurities from the sewage" means much more than "Primary treatment will reduce suspended solids 50 percent." He must be guided in comparisons which demonstrate the effectiveness of sewage treatment in the plant. In a primary treatment plant, for instance,

comparison of raw sewage and final effluent is not effective. A view of the sludge being removed from the primary tank or discharged from a vacuum filter is more effective. In a complete treatment plant, a comparison of the raw sewage and a clear final effluent is effective once the clear final effluent is being produced. Publicity in advance of starting operations should emphasize the sludge removed in one case and could emphasize the final effluent in the other. Publicity which emphasized the purity of a primary effluent could backfire and cast doubts on the effectiveness of a perfectly satisfactory effluent.

The municipal officials should also have some estimate of the time required after operations start to produce the normal plant effluent and of the time required to visibly change stream conditions. In both cases, it is best to overestimate the time required. "Everyone is happy to be associated with excellent operators, a well designed plant, and outstanding municipal leadership which resulted in good operation being established sooner than could have been anticipated."

Reduction of pollution is not an adequate description of the effect of the sewage treatment plant on the stream. Elimination of odors, improved or new fishing, elimination of oil, greases and floating sewage material are much better descriptions. "Opening beaches which had been closed by pollution" is a much more effective statement than "reducing the coliform bacteria" although both can mean the same in a given instance. If the sewage treatment plant does not produce any visible physical improvement in the receiving waters within a few miles of the plant effluent, it is best to emphasize the treatment in the plant.

It should be emphasized to the municipal officials that the sewage treatment plant is the only visible (to the voters and newspapers) evidence of a large sum of money for a sewerage system. Neat landscaped appearance is inexpensive to provide and maintain and makes the plant something for the voter to be proud of and to support.

The municipal officials should also know that the first few months of operation may be hectic. They should know that it takes time to produce an effective biological growth. They should be advised of the things which might go wrong so that they will not be surprised. Thus they can handle public relations problems which may crop up in the first few months of operation.

An adequate staff and operating budget must be worked out with

the municipal officials within the framework of the municipal salary ranges and organization. Items which must be included in the budget are salary for operation and maintenance staff, operating supplies, maintenance supplies, power, water, chlorine, chemicals, vehicles, employee benefits such as social security, hospitalization, and pensions, and insurance.

Vacations are a problem because they reduce the staff in the summer time when treatment is most critical and when outdoor maintenance can best be done. If each of a 48-man staff takes two weeks vacation in a 12-week period, one sixth or 8 men will be on vacation all the time. These men must be replaced when they are on vacation. Summer help is usually a less expensive answer than overtime by regular employees. If possible, the staff and budget should be worked out with the assistance and approval of the superintendent who will supervise the operation and maintenance staff. This procedure will minimize later changes which are sometimes required to fit the staff and budget into the pattern favored by the superintendent. Included in the first year budget should be a 5 to 10 percent contingency for extra personnel and for equipment and minor changes in the first few months.

This first section is aimed at putting the municipal officials in a position where they cannot be second guessed or place themselves or be placed in an untenable position. Happy, confident municipal officials will usually support the start of operations and will continue this support. Although we have called this the first stage of starting a sewage treatment plant, it is obvious that holding the support of the municipal officials and voters must continue as long as the sewage treatment plant operates.

The second stage of starting a sewage treatment plant begins with the recruiting of the staff. In large plants, the top staff should be on the job as soon as mechanical equipment and pipe begins to go in. This is also desirable in the smaller plants. In any case, the entire staff should be on hand at least a month before operations are expected to start.

The staff is given lectures on the treatment plant in general; what it will accomplish, how the receiving waters will be improved, their own specific jobs, and the organization of the various parts of the staff.

Make each staff member—operator, laborer, maintenance man or truck driver—a good will ambassador for the treatment plant. Each

man who works at the treatment plant is an expert to his neighbors. Give him the information to be the expert. He will be happier and do a better job. He will generate much favorable publicity.

During this period, the staff learns by examination where pipes go, what valves to use, how to start pumps and all the other details of their job. One plant gave their operators problems such as getting sludge from here to there; what will you do if the dry well starts flooding; how will you relieve the overflowing primary plant. The problems were solved by tagging valves to be opened or closed and tagging pumps to be started, etc.

Maintenance men and instrument men could be sent to school during this period. Equipment manufacturers have set up schools which are usually tuition free.

The sewage treatment plant must appoint a supervisor of maintenance at least a month before operations start. The manufacturers' representatives must give their maintenance advice and instruction to this supervisor or to his designated assistant and to no one else with the possible exception of the Consulting Engineer's representative. If they give advice to other staff members, the advice may not get to the responsible maintenance supervisor and may be wasted. Manufacturers will give most effective service to a well-organized staff and will save time in giving the better service.

After the equipment manufacturer's representatives have talked to the supervisor of maintenance, they should lecture to the staff on the maintenance and operation of their equipment. These equipment manufacturer's representatives should return again in the first month after operation actually begins to check operation and especially to check maintenance. They should be scheduled so that they come to the plant on separate days. If several arrive on the same day, their time may be wasted and the staff does not get the full benefit of their visit.

The Resident Engineer has collected equipment and operating instructions and should turn them over to the chief of the operating staff as soon as he is employed.

An operations manual must be prepared showing the capacity and use of equipment and facilities. The size of tanks, the rate of collector travel, the head-discharge-efficiency-power curves for pumps, the operating pressures for hydraulic systems, and the size of comminators

or bar racks should be compiled so that the data is readily available. Schematic piping and flow diagrams for sewage, sludge, chlorine, water, and other materials must be prepared. These should show all possible interconnections as well as normal routes of flow. This information should be basic and not affected by changes in operating procedures.

In addition, a detailed initial standard operating procedure must be established. It should be posted at operating stations and followed by all operators. This is absolutely necessary since shift operation requires that four men occupy each position. If they all follow established procedures, undesirable ones can be weeded out rapidly. If they each operate independently, good and bad procedures may be so mixed up that they cannot be identified. However, every man should be encouraged to be on the watch for better operating and maintenance procedures and any showing promise should be tried. It is to be expected that much of the initial standard operating procedure will be changed by experience.

Shop drawings have been accumulated by the Resident Engineer and should be turned over to the sewage treatment plant superintendent as soon as he can receive them. We make a practice of collecting two or three copies of each. We suggest that one be kept in the official file, one in the maintenance supervisor's office and one or more in a separate file in the maintenance supervision office for field use.

The laboratory staff must be oriented in plant operation and in their laboratory work. Their services and the information which they will provide will be indispensable as soon as operations start. The staff will need most of the month to unpack, sort and prepare equipment and supplies, and to make solutions.

The operating report forms must be designed and be ready before operations start. They must meet state requirements for minimum information and also record data which will make control of operations easier. They must also accumulate data on which plant expansions and changes for better or more economical operations can be based. In addition, forms should be designed for recording the operating data in the plant which will be incorporated into the operations report or be used to control treatment.

During this period, decisions are made to treat all or part of the sewage initially or to start all or part of the units at once. Sometimes,

as in the case of a replacement for an old plant, all of the sewage is immediately available for treatment. Even so some can be by-passed or treated as it was before the new plant was available. Authorities whose income is from revenue usually like to receive all the sewage as soon as possible so that participants can be charged and the project becomes self-supporting at the earliest possible moment. My personal preference is to take all the sewage as soon as possible. I see no objection if the plant is adequately designed with duplicate equipment. On the other hand, some problems will develop faster and can be dealt with sooner and in the period when problems are expected if all the sewage is received at once and all units are started as sewage or sludge reaches them.

As the day for receiving the first sewage approaches, each operator and his supervisor tests pumps, valves and all other equipment to see that they are in operating condition. Examinations are made to be certain that tanks and pipes are free of debris and motors have the correct rotation and will start. The more carefully this job is done, the fewer problems will be experienced when the plant operation starts. All this has to be done under careful supervision and with due concern for the Contractors still on the job. Procedures should be established for volumetric checks of flow meters as tanks are filled.

It must be emphasized to the operations staff that the success of the operation depends on them. Their job is to operate the equipment, to clean pumps when required, to open valves, to close valves, to clean up, to dirty the place again while cleaning a pump, and to clean up the floor again. Probably some of the automatic control equipment will not operate satisfactorily at first. Without water or sewage, it could not be tested. The staff must understand that the first few days of operation are the most hectic, partly because of untested equipment, and partly because they are inexperienced.

Unusual items will be received at the sewage treatment plant or found in treatment plant equipment as a result of construction. At the time when the operating staff is new and least able to cope with bolts in pumps, clay in primary sludge, and rocks on bar screens, these things will appear. I would not be surprised to find any item in a pipe or tank if it could be fitted into it. Fortunately there is an excitement of the first flow of sewage into the plant which helps to carry the staff through the first few days.

Greasing, oiling, and maintenance must be put on schedule immediately. The Contractor greases and oils before he releases the equipment. The next greasing and oiling must be done by the sewage treatment plant staff. Some greasing will have to be done on the first day of operation. The most effective system is to have a complete list of all equipment and motors, together with the manufacturer's recommendation for greases and oils. Generally this should be reviewed by the company which will supply these items. The required lists of greases and oils can usually be markedly reduced. The major oil companies are glad to provide this service. Maintenance men must have their grease guns at "Ready" when sewage enters the treatment plant.

Spare parts should be purchased, stored and catalogued before the plant starts. There will never be a time when spare parts will be needed more urgently than at start up.

Electrical equipment such as motor overload heaters tend to malfunction in this period due to improper sizing for the conditions. Perhaps the power distribution center is in a warm room and the overload heaters shut off the motor at too low a current.

In this period too, equipment which is being used for the first time invariably produces problems if it is ever going to. Manufacturers will usually assist promptly.

This initial operating stage ends when sufficient equipment can be kept in operation to treat all the sewage all the time with a reasonable effort. With normal duplication of treatment units, this usually occurs in a week or less.

The third stage "Refining Operations" continues forever. A good operation staff is never satisfied with existing conditions. Opportunities are always available to improve operations or to save money in operations or in maintenance.

Early in this stage, the prime objective is to keep the treatment plant operating. Therefore, the maintenance staff first attack mechanical instrumentation, control, and electrical problems which could prevent operation of equipment. The engineer and the equipment manufacturer are generally involved since the guarantee period has not expired.

In general, even if defective, equipment which can be repaired easily and inexpensively by the sewage treatment plant maintenance staff should be repaired by it. Disputes over defective equipment which

can be repaired for a few dollars cost many many times the amount in staff time. In addition the staff gets valuable experience when the equipment manufacturer is still readily available.

Defective equipment with large costs for repair must be repaired by the Contractor. Experience has taught me to call the Contractor and equipment manufacturer and at the same time advise the Contractor in writing that the equipment is defective and in accordance with the contract will be repaired by the municipality at his cost if repairs have not been started in the prescribed days.

Problems with equipment which may stop operations are usually cleared up rapidly. When they are, a schedule of testing all equipment, mechanical and electrical, should be started. All pumps should be tested. Pump motor amperage should be determined. Control systems should be checked completely. If an alarm should ring at high level, shut off the pumps and see if it does.

If pumps should start and stop on a schedule, find out if they do. If several pumps are designed to start in series as the wet well rises, place them on automatic control and let the wet well rise. If it will not rise high enough to start all the pumps, manually stop some of the pumps which started at low level. Make volumetric checks on meters. Be certain that solenoids are operating. Try all valves and gates. Try all possible operations no matter how unlikely that they may be used routinely. As these things are being checked initially, set up schedules for checking some of the equipment routinely. For instance an important mechanized by-pass gate should be checked monthly to be certain it will work when needed in an emergency. Automatic standby power which should start during a power failure should be checked monthly by cutting off power.

As these things are being done by the operators and maintenance people, look for improvements. Where could lights be added? Should this valve handle be extended? Should this variable speed motor be speeded up? Should this pump be operated on only one shift. How much chlorine should be added? In short many minor changes will markedly improve operation or minimize maintenance.

This third stage is the most important for the least expensive and most effective operation. It depends on the operation staff.

To all municipal officials and to all voters, to all engineers—proclaim that the sewage treatment plant is only as good as the operation staff.