

Wastewater I Course

Sponsored by
Geauga County General Health District

In 1984 House Bill 110 was passed into law by the Ohio House of Representatives. This Bill allowed for the Ohio Environmental Protection Agency to defer the inspection and monitoring of small commercial sewage disposal systems to local agencies. The Geauga County General Health District entered into a contract in 1994 with the Ohio Environmental Protection Agency to inspect, monitor, and report on the performance of the Semi-Public or commercial sewage disposal system in Geauga County. The Semi-Public sewage disposal system is defined as a disposal system which treats the sanitary sewage discharged from publicly or privately owned buildings or places of assemblage, entertainment, recreation, education, correction, hospitalization, housing, or employment, but does not include a disposal system which treats sewage in amounts more than twenty-five thousand gallons per day; a disposal system for the treatment of sewage from a single-family, two-family, or three-family dwelling; or a disposal from treatment of industrial wastes.

Through this inspection program it was determined that there was a need for the owners of these small treatment systems to learn more about how the systems operate. Many of these systems were in disrepair and not functioning adequately to treat the sewage. They were not being operated and maintained as designed and the quality of the effluent was not meeting the required limits established by the Ohio Environmental Protection Agency for various parameters. These effluent discharge

perimeters include suspended solids, biological oxygen demand, chlorine residual, fecal coliform, and ammonia limits that must be met by systems that discharge to the environment. Many of the treatment systems were obsolete and were not capable of adequately treating the wastewater and meeting these standards even when they were in operation or functioning properly. Through this inspection program several obsolete systems were upgraded to meet current standards and improvements and additional components were added where necessary. As these changes occurred it became evident that the operators of these systems lacked the skills needed to properly operate, maintain, and monitor the wastewater treatment systems. It became apparent that training for the operators was an essential element to ensure the small wastewater treatment system functioned properly and the sewage was being properly treated.

A training program was implemented in November of 1995 to provide the owners with the much needed training. These short one or two day training workshop have been conducted annually since they began in an effort to provide information to the owners and operators of these systems. These workshops have been very successful. The one or two day sessions covered the basics on how to operate and maintain these small wastewater treatment systems. Several of these wastewater systems were also under a National Pollutant Discharge Elimination System Permit and required Licensed Wastewater Operators to oversee the operation, maintenance and reporting for the wastewater treatment system. The training sessions that were being conducted did not provide sufficient training for the individuals who needed to obtain their Wastewater License. A

more extensive course was needed to provide the additional material, training, and experience for these individuals.

The Operator Training Committee of Ohio is a State Agency that offers workshops, seminars, and training courses on wastewater treatment for Licensed Wastewater Operators in Ohio. These courses are designed for the operators of large municipal wastewater treatment facilities who work full-time in the wastewater industry. Small extended aeration systems vary considerably from the larger municipal systems in size, treatment components, characteristics of the treatment process, and procedures and operational techniques used to treat the sewage and maintain the wastewater system. The courses that are offered do not cover sufficient material for the operators of the small package treatment systems. For this reason the Geauga County Health District contacted the Operator Training Committee of Ohio and requested that they allow the Health District to design a course that would meet the needs of the operators of the small wastewater treatment system. Permission was granted and the Wastewater I Training Course was redesigned to include the various components, techniques, and procedures, and the differences and similarities, associated with the extended aeration treatment systems in addition to all materials regularly offered in the course. This resulted in adding three additional weeks to the course to cover all of the additional material that was being offered. The length of the course was 23 weeks. An instructor was contacted who was qualified through the Operator Training Committee of Ohio to teach the redesigned course. The instructor requested the class enrollment be kept small due to the lack of experience of the operators and the

type of material to be taught. Letters were sent to owners/operators of these small systems who would be required to have a licensed operator in the responsible position operating the wastewater facility. Ten individuals enrolled in the class were from various sized and types of wastewater facilities serving several commercial sites in Geauga County.

These extended aeration treatment systems vary in size and components. However, they all fall into the category of Semi-Public wastewater treatment systems under the 25,000 gallon per day and serve sites as defined previously. Two of the individuals were responsible for the operation and maintenance of two separate wastewater treatment systems for nursing homes treating 15,000 gallons of sewage per day. One individual operated two mobile home parks treating 15,000 GPD and 20,000 GPD each. Two school maintenance staff attended who operated schools with a flow of 8,000 GPD for each school. A camp sent its maintenance staff to attend which oversees an 8,000 GPD and a 15,000 GPD wastewater system. A Geauga County Agency sent its maintenance staff that cares for a 20,000 GPD wastewater plant. One participant is under contract with several treatment system of various sizes to operate and maintain adequately. Half of these systems are either under NPDES Permit or will be required to be under Permit status. This will require them to be operated by a Licensed Wastewater Operator.

The course was set up to consist of four parts or topic areas. These parts were to categorize topics into similar groups following the treatment process. The first portion of the course was math, mechanical components, and primary

treatment of the sewage. The second section was on biological treatment of the sewage and comparing the different types of treatment. This covered conversion and separation of the solids in the secondary treatment phase for both the activated sludge system and the extended aeration systems. Part three covered the tertiary treatment and disinfection methods of wastewater treatment. This included testing and monitoring of the treatment process and of the effluent to determine the quality of the effluent discharged. Part four consisted of topics on process control procedures, safety, laws and regulation governing wastewater treatment. In addition, four tests were administered in the 23 week course over material that was covered including the final exam.

The Wastewater I Course that was offered followed the course outline implemented by the Operator Training Committee of Ohio. The course and instructional material was altered and additional material was added to provide more relevant information regarding wastewater treatment for small extended aeration treatment systems. The course agenda was established in a progressive format following the treatment process. Session one provided an overview of wastewater treatment and covered basic math concepts and essential math calculations and formulas for wastewater operators. These were very fundamental mathematical equations that are necessary in calculating tank and chamber sizes, flow, and organic loads involved in wastewater treatment. Through this information it will allow them to determine the loading rates of their treatment systems and become familiar with the capabilities of their individual systems. As part of the instruction and homework they were

assigned projects to make these calculations on their individual systems.

Each succeeding week the topic progressively followed the course of the waste stream through the treatment process. Basics of pumping, hydraulics and blower/motor sizing and maintenance were covered in week two. Primary treatment followed the pumping section with a comparison between the large municipal treatment system and the small extended aeration treatment plants and how they each function. The concept of separating the organic material from inorganic material and how this is achieved using varying types of equipment and components. Secondary treatment covered the breakdown of the solids and the various methods for this conversion. Topics relating to biological and media growth and how it functions in wastewater treatment was also covered. The importance of the bacteria in the treatment process was discussed and how different types of bacteria effect the operation of the treatment system. Three training sessions were devoted to the basic concepts of activated sludge and the differences between activated sludge treatment and extended aeration treatment and solids management for both types of systems. Anaerobic and aerobic treatment was covered along with sludge stabilization methods in the treatment process.

The third part covered tertiary treatment and the theories of disinfection of the effluent using both chemical and ultraviolet light. Several methods of disinfection were discussed and the hazards involved with each. Sampling techniques, requirements and process control were introduced.

Part four of the course covered material on safety, laws and regulations.

Four sessions were conducted at a wastewater treatment facility. During the site instructional sessions the participants were introduced to the various components associated with the wastewater treatment process. These were components that were not standard features of the small extended aeration systems. The concept of sludge dewatering and disinfection which are relevant to the small system differ in equipment, technique, and procedure from what is used in larger systems. Several other type of treatment components were also on location and available for demonstration purposes such as, trickling filters, grit chambers and communitors, solids wasting, activated sludge chambers, and clarification chambers. The components were in operation and the participants were able to better understand the concepts and differences in sludge dewatering with a belt filter press in larger systems verses sand drying beds used in the extended aeration plants. Disinfection for the extended aeration system is a tablet chlorinator and the larger system may have multi-unit ultraviolet lamps or chlorine gas for disinfection. These types of components were demonstrated and explained during each training session at the wastewater facility. One of the sessions at the wastewater facility dealt with laboratory analysis and the proper collection and preservation of wastewater samples. Test procedures were demonstrated on solids testing, Carbonaceous Biological Oxygen Demand, Ammonia, and various other parameters. The tests that were demonstrated were basic process control tests that would allow the operator to

make needed corrections or changes to their systems and improve the overall performance of the their treatment plants. The participants were also able to bring in samples from their system for analysis which showed how the system was operating. They got immediate feedback from this information and had a better understanding of what was occurring in their systems. Several test and monitoring procedures were discussed that are relevant to extended aeration treatment systems in regards to proper operation, monitoring, reporting, and overall process control. A variety of tests were done using samples and various methods to demonstrate the techniques involved in sample testing. The results of each test were discussed during the laboratory training to further the training process. The importance of monitoring and recording the results of all the tests to determine how the system is functioning was strongly emphasized throughout the course.

Numerous on site tests and monitoring techniques were discussed such as dissolved oxygen, settability test, ammonia, temperature, pH, odor, and chlorine residual. Through the Grant each site was provided with an ammonia test kit. The Ammonia test kit was chosen because ammonia will indicate the effectiveness of the treatment process. If a low ammonia result is recorded the organics are being properly broken down and the effluent and the sewage is being adequately treated. The Ohio EPA has a specific discharge limit for ammonia. The ammonia test kits will be used for monitoring the effectiveness of the treatment process in the wastewater plant. Although the kits are not acceptable for reporting purposes for any NPDES Permit requirements they will be valuable in testing the operation of

the system. These test kits will allow them to continue to monitor their treatment system after the course ended. The importance of proper recordkeeping was emphasized in during the entire course. The ammonia test kit added to the monitoring that was already in place for several sites.

There are two ways in which this Wastewater Course was evaluated. First was the success of the participants in gaining knowledge and understanding of the wastewater treatment industry for both the large facilities and the small extended aeration treatment systems. The second method of evaluating the success of the program is the operation of their wastewater treatment facilities after the Wastewater Course ended.

Three methods were used of assessing the improved knowledge level of the participants for the course. First, throughout the course the participants were given exams over material that was covered. These exams were used to assess the level of understanding of the participants. The tests covered material that was previously covered. The math portion of the course was the most critical. Several participants seemed to struggle with the basic math that is involved with wastewater treatment. All succeeding sections of the course involved math calculations to understand the concepts being taught. The results of the first exam were such that additional time and instruction was given to the math portion of the course. Depending on the level of understanding of the math concepts indicated how the individual was progressing in comprehending the associated material. Secondly, attendance was required for all classes and participation was expected and recorded as part of their

evaluation. Over the twenty-three weeks of the course they became more responsive and demonstrated more ability to verbally ask or answer questions and become involved in dialog regarding their treatment system demonstrating a more thorough knowledge of the systems. It was apparent that those who did not turn in the written assignments or who missed two or more classes were not able to contribute in the class discussions. Their understanding of the treatment process was not at a level of the remainder of the participants who did comply. Third, a final comprehensive exam was administered over the entire course material that was covered for the twenty-three weeks. One extra session was added to the course the week following the final exam so the results of the exam could be discussed and to assist the participants in understanding their mistakes.

There were 10 individual who signed up for the Wastewater I Course. Four attended all 23 sessions. The participants who attended 90% of the sessions did relatively well in the course with a grade of 85% or better. One participant who attended all sessions had difficulty with the math portion of the course and had a passing grade of 75%. Two participants missed only one session. Three participants missed more than two sessions which negatively effected their understanding of the concepts in course material. This was reflected in the poor grades at the end of the training course. One participant withdrew from the class after the fourth week.

Four of the participants elected to continue on to the next step and registered for the State Class I Wastewater Exam that was being offered. Three of the four received passing grades

and two are now Class I Wastewater Operators. One is an Operator-in-Training and accumulating time to qualify for his Class I Operators License. One individual was within one point of passing and will be taking the exam in the future.

The second method of evaluating the course is through the improved performance of the individual treatment systems. Through this Wastewater I training Course there has been an improvement in the overall performance of the treatment system where the Workshop participants are in control of the treatment system. Through the information that was provided, there has been improved operation and maintenance of the systems. Seven of the sites had no violations during the inspection of the treatment system. There was evidence that the sites were being properly operated and maintained. Monthly records were being kept on each site and the systems were being monitored. Various testing equipment was being used and the results recorded. The one site where the individual withdrew from class after the fourth week had numerous violations in both the operation and the maintenance of the treatment system. The remaining systems had only minor infractions such as, replacement of splash blocks, alternating filter beds, and securing the facility, which did not directly impact the effluent quality.

In conclusion, it can be determined that the success of the program will be able to be measured for many years. The immediate success is the improved knowledge by the operators of how these small extended aeration wastewater systems function. They are better able to make critical decisions regarding sizing the system properly, loading rates on the system, they can now

evaluate the treatment process to determine how it is operating. They have a better concept of the various biological methods to the treatment process and the effect of not maintaining a proper balance in the biological process within the treatment system. They are more aware of the necessity of proper record keeping and the value of conducting the tests to evaluate the various stages of the treatment process and the quality of the effluent that is discharged to the lakes, rivers, and streams in Ohio.

A second benefit of the Wastewater I course is that four individuals elected to take their Wastewater Exam. Through this course they were better prepared for the challenge of taking this exam. This course can be credited with providing the individuals with the knowledge about wastewater and how the wastewater systems operate. The experience gained and the exposure to various types of treatment systems, components, and equipment, used in the wastewater industry increased their understanding of wastewater treatment so they were better prepared to take the wastewater exam and obtain their wastewater license was invaluable to them.

The most important benefit from this course is that the wastewater treatment systems that are being operated by the individuals from this course have improved. There are fewer violations recorded for wastewater treatment system where the operators have a working knowledge of how to operate the system. They are better able to identify the problems and make any needed corrections to the treatment process as they are needed. They can make adjustments in the systems that would enhance the performance of the system to produce a better quality effluent.

They understand the importance of keeping records and monitoring the plant on a daily basis. Through the safety training portion of the course they also are more safety conscience and aware of the dangers of working in the wastewater industry.

Through these examples it is evident the course was beneficial to the individuals involved in the course, but also to the environment. These individuals are more fully aware of how these systems operate and what is required to keep them functioning properly so the quality of the effluent that is discharged will meet the limits established by the Ohio EPA. Through this effort the conditions water in the rivers and streams will improve.

WASTEWATER I - TRAINING SCHEDULE

DATE	WEEK	TOPIC	LOCATION
Mon. 11/06	1	Introduction/Course Overview	G.C.H.D.
Mon. 11/13	2	Basic Wastewater Math (Part I)	G.C.H.D.
Mon. 11/20	3	Basic Wastewater Math (Part II)	Solon
Mon. 11/27	4	Basic Pumping & Hydraulics	G.C.H.D.
Mon. 12/04	5	Preliminary Treatment	G.C.H.D.
Mon. 12/11	6	Primary Treatment	G.C.H.D.
Mon. 12/18	7	Attached Growth	Solon
		<i>HOLIDAY BREAK</i>	
Wed. 1/03	8	Attached Growth	G.C.H.D.
Mon. 1/08	9	Exam #1	G.C.H.D.
Wed. 1/17	10	Exam Review / Start Activated Sludge	G.C.H.D.
Mon. 1/22	11	Continue Activated Sludge	Solon
Mon. 1/29	12	Process Control / Basic Lab Testing	G.C.H.D.
Mon. 2/05	13	Extended Aeration	G.C.H.D.
Mon. 2/12	14	Maintenance	G.C.H.D.
Mon. 2/19	15	Solids Management	Solon
Mon. 2/26	16	Natural Treatment Systems / Disinfection	G.C.H.D.
Mon. 3/05	17	Anaerobic Digestion	G.C.H.D.
Mon. 3/12	18	Aerobic Digestion & Other Stabilization	G.C.H.D.
Mon. 3/19	19	Exam #2	Solon
Mon. 3/26	20	Review Exam #2 / Laws, Regulations	G.C.H.D.
Mon. 4/02	21	Safety	G.C.H.D.
Mon. 4/09	22	Training / Continuing Education / Review	G.C.H.D.
Mon. 4/16	23	Final Exam	Solon