A Survey of In-Service Training of Water Treatment Systems' Operators in Michigan

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A SURVEY OF IN-SERVICE TRAINING
OF WATER TREATMENT SYSTEMS'
OPERATORS IN MICHIGAN

by
Alouch Whitfield, II

A Project Report
Submitted to the
Faculty of The Graduate College
in partial fulfillment
of the
Degree of Specialist in Education

Western Michigan University
Kalamazoo, Michigan
December 1979

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For my devoted wife, Norris, and family, I can only say, "Thank you, Master, for such a blessing."

Alouch Whitfield, II
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WESTERN MICHIGAN UNIVERSITY, ED.S., 1979

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CHAPTER I

INTRODUCTION

Problem Statement

The purpose of this study was to investigate the participation of water treatment systems' operators in training courses in Michigan.

The need to investigate this problem is revealed by the licensing system which exists for granting certification to water treatment operators.

The Michigan Department of Public Health requires that individuals employed as operators within water treatment systems must submit their application for certification as a licensed water treatment operator within a minimum of one (1) year of their hiring date into that treatment system. This application contains a detailed list of criteria upon which the applicant's eligibility to write the licensing examination is determined.

The Safe Drinking Water Act of 1976 holds the Michigan Department of Public Health responsible for carrying out the following (Act 399, Public Acts of 1976):

- to provide for the classification of public water supplies and the examination of persons operating those systems;
- to provide for continuous, adequate operation of privately owned, public water supplies;
- to authorize the promulgation of rules to
carry out the intent of the act; and to provide penalties.

Sec. 9. (1) The department shall classify water treatment and distribution systems with regard to size, type, location, and other physical conditions for the purpose of establishing the skill, knowledge, and experience that individuals need to maintain and operate the systems effectively. (p. i)

(4) For individuals meeting the requirements, the department shall issue certificates acknowledging their competency to operate a specified class of water works system or portion thereof. The department may suspend or revoke a certificate as specified by rule.

(5) A water treatment and distribution system shall be under the supervision of a properly certified operator as specified in the rules. (pp. iv-v)

Although the Advisory Board on Certification of the Michigan Department of Public Health, an eight (8) member body of certified operators and laymen (Water Works News, April, 1978) provides credit for an applicant's accumulated elementary, secondary, undergraduate, graduate, and post-graduate educational achievements; the Board also issues "Continuing Education Units (CEUs)" upon the successful completion of in-service training courses. All of these credits and units are converted into "educational qualification points" to be utilized in the process of granting the applicant permission to participate in writing the certification examination.

However, once the individual has attained the highest
level of certification prescribed for his/her water treatment system, there does not exist a compulsory nor an organized program of training courses for these certified operators. This lack of training course offerings points out why further investigations of this problem should be conducted to explore the necessity of up-dating, re-training, continuous training, and the application of contemporary innovations in engineering/science in the field of water treatment.

Significance of the Study

The major significance of this study was to initiate and conduct the investigation of a previously unstated assumption. The data collected provided statistically legitimate information on variables that were suspected of being associated with post-certification participation by water treatment operators in training courses sanctioned by the Michigan Department of Public Health's Advisory Board on Certification.

Examination and analysis of these variables' interactions could provide the Michigan Department of Public Health's educational staff with a concrete body of knowledge. Post-certification training course needs, availability, scope, and projections could therefore be based upon research data.
This investigation was a systematic survey of the present status of post-certification training as offered by the Michigan Department of Public Health and as utilized by operators working in complete filtration treatment facilities.

The most unusual aspect of this study was its utilization of respondents (water treatment operators) who had not yet been academically surveyed by the Michigan Department of Public Health's educational office. This particular group of water treatment systems' employees was asked to indicate their past and anticipated interest in participating in in-service training, especially the sanctioned training courses.

Purpose of the Study

The primary purpose of this study was to investigate a selected number of variables provided by the liaison educational staff of the Michigan Department of Public Health. According to their collective professional opinions, these variables were associated with the water treatment operators' participation in in-service training programs, especially the sanctioned training programs. This study was specifically designed to establish comparisons that might exist between participation in in-service training courses and levels of operator certification, frequency of course offerings, length of
courses offered, credit(s)/points issued for course participation, pre-certification versus post-certification participation by operators, and selected employment and demographic variables existing within respondents' local water treatment systems.

Some Parameters of the Study

This study was conducted with five underlying parameters as follows:

1. The highest level of certification attainable by water treatment operators had been pre-determined by the classification of their respective water treatment systems.

2. The number of pre-certification training courses sanctioned by the Michigan Department of Public Health's Advisory Board on Certification was unlimited.

3. The number of post-certification training courses sanctioned by the Michigan Department of Public Health's Advisory Board on Certification was limited.

4. The number and types of pre-certification employment incentives that exist within the water treatment systems was unlimited.

5. The number and types of post-certification employment incentives that exist within the water treatment systems was limited.
Limitations

This study was conducted under the following limitations:

1. The findings of this study were analyzed in terms of relationships, but not necessarily in terms of cause and effect.

2. The study was limited to complete water treatment systems only.

3. The respondents were limited to water treatment systems' employees who have been issued F-1, F-2, F-3, or F-4 certificates.

4. The survey was limited to the entire state of Michigan (both upper and lower peninsulas).

5. The survey was limited to the objectives specifically included in the design.

Definitions of Concepts

Advisory Board on Certification. The Advisory Board on Certification is the Board appointed by the Michigan Department of Public Health to issue certification to water treatment systems' personnel.

Certification. Certification is the process by which a document is issued by the Michigan Department of Public Health to an individual meeting the qualification requirements for the operation of a water treatment system.
Certified Operator. A certified operator is an operator who has been licensed by the Michigan Department of Public Health's Advisory Board on Certification.

Continuing Education Units. Continuing education units are individual credits provided for every ten (10) hours of participation in a training course sanctioned by the Michigan Department of Public Health's Advisory Board on Certification.

In-Service Training. In-service training is all of the organized activities approved by the Michigan Department of Public Health for the professional or educational improvement of water treatment systems' personnel.

Instructor. An instructor is any individual who has received certification to teach specific disciplines from an accredited organization. This individual's certification to teach training courses for operators must also be approved by the Michigan Department of Public Health.

Michigan Department of Public Health. The Michigan Department of Public Health is the official state agency that governs all of the water treatment systems in the state of Michigan.

Operator. An operator is an individual who is responsible for some aspect of water treatment in a public or private water treatment system in the state of Michigan.
Respondent. A respondent is a staff member of a water treatment system possessing the employment classification of superintendent, chief plant operator, or plant operator in a public or private water supply in the state of Michigan.

Training Course. A training course is a course of study provided for water treatment systems' operators that is sanctioned by the Michigan Department of Public Health's Advisory Board on Certification.

Water Treatment System. A water treatment system is a public or private water facility monitored by the Michigan Department of Public Health.

Organization of Survey

Chapter I contains a statement of the problem, the significance of the study, the purpose of the study, the assumptions, the limitations, the definitions of terms, and the organization of the survey. Chapter II is composed of the background literature that provides a basis for the policy of the Michigan Department of Public Health which affords operators the opportunity to participate in in-service training programs. Chapter III, Design of the Study, is composed of an overview of the Procedure, questions, variables, sources of data, methods of gathering data, instrumentation, and data analysis for the questions. Chapter IV contains a report of the
findings. Chapter V contains a summary of the study, discussion of the findings, conclusions drawn from the findings, and a statement of implications.
CHAPTER II

RELATED LITERATURE

This investigation included the examination of literature related to the previously unstated assumption of operator participation in in-service training programs. This literature review revealed further substantiation of the necessity for conducting this study.

Ten (10) years following the construction of waste water treatment systems in the areas bordering Lake Huron, Lake Erie, Lake St. Clair, and the Detroit River, the first academic training courses were instituted. In the year 1934, operators working in these water treatment facilities were offered an opportunity to participate in gaining academic training in the subject areas of bacteriology, mathematics, chlorination, and chemistry.

Following the 1941 enactment of the legislation requiring the water treatment plant operators to be certified, the operators' lack of adequate minimum educational credits (as established by the regulations), emphasized the need for a statewide organized educational program. The initial extension courses were developed for training in the areas of water engineering, aquatic biology, hydraulics, water chemistry, and water bacteriology. To keep pace with the rising demands for
training in broader fields of water works practices, courses have been developed in the additional areas of personnel, supervision, and distribution.

Training programs in Michigan are exemplified by the following types of courses (Report on Water Requirements for Municipal Use, 1966):

1. Twelve week separate extension courses in chemistry, hydraulics, water supply engineering, fresh water biology, and bacteriology. These consist of 2 and 3 hour sessions each week at about 18 convenient locations in the state.

2. Two and three day in-service training conferences, usually held at one of the state universities on separate subjects such as filtration, coagulation, safety, water main disinfection, waterworks management, and radioactive liquid wastes, with leading authorities in the country selected for the staff.

3. Special 2 and 3 day courses have been conducted in such fields as fresh water biology and laboratory instrumentation. These were laboratory courses with the prime objective to have the participant work with the actual equipment.

4. Annually a 3 day course is given in water bacteriology and chemistry, which includes both beginning and advanced sections in each field. The course consists of lectures followed by laboratory tests performed by each participant.

5. One day regional meetings at 6 different locations in the state have been held annually for the smaller waterworks operations which have no treatment or treatment other than conventional filtration.
6. More recently, a different type of venture has been accomplished for both water and waste water plant operators. This was the presentation of 12 week courses in mathematics in 1961, basic chemistry in 1962, applied mathematics in 1964, and applied hydraulics in 1966. The courses were presented at 10 to 18 different locations through the adult education program at various local schools. The course material was developed in considerable detail so that the material presented was common to all schools. Selected plant operators with training and experience were utilized as instructors. (pp. 29,30)

Michigan had established its philosophy of educational training upon the limitations of: (a) the structural facility, (b) the mechanical equipment/apparatus, (c) the individual treatment processes/techniques, (d) the vital and extreme need for the exercise by operators of logical and proper judgment in the resolution of problems encountered while on their jobs. Therefore, the principal objective of this entire program is to develop the ability within operators to make the appropriate decision, based upon his/her working knowledge and sound judgment.

To keep abreast of the rapidly developing field of water treatment practices/techniques and the ever dynamic standards/regulations; the managers and operators of water treatment systems across this continent need to be highly qualified in order to achieve the efficient, effective, and economical operation of their treatment facili-
ties. The majority of the United States and Canadian provinces, who through independent efforts have attempted to provide their water treatment managers and operators with this essential and necessary training, have repeatedly demonstrated the inadequacy of their singular endeavors. Their collective experiences have illustrated the overwhelming need for leadership.

Such leadership could possibly achieve the following:
(a) coordinating independent efforts of states, (b) providing objectives/priorities for sharing joint resources, (c) providing guidance for the participants (both states and provinces of Canada) to develop/remodel training programs, (d) developing training materials that not only satisfy the identified needs of various certification programs, but also meet the training need of the treatment technicians, (e) assessing the training materials/programs offered by the participants (states and provinces of Canada) (*A.B.C. Directory, 1977*).

Alger (1963) believed that vocational education programs could provide a positive impact on in-service training programs through planning/organization to:
(a) up-grade skills, (b) prepare for employment advances, (c) provide basic training and education in-service for additional professional achievement.

Realizing the immense size, scope, and significance of this task, four (4) nationally involved/recognized
organizations arrived at the following conclusion (A.B.C. Directory, 1977):

Recognizing their capabilities for providing this leadership, the American Water Works Association (A.W.W.A.), the Water Pollution Control Federation (W.P.C.F.), the Association of Boards of Certification (A.B.C.), and the Federation of Associations on the Canadian Environment (F.A.C.E.), appointed representatives to a joint standing committee known as the Joint Training Coordinating Committee (J.T.C.C.). (p. 1)

This committee planned to direct its energies toward a common objective which would enable all educational, professional, and regulatory agencies to funnel all of their training funds and manpower into a coordinated organizational entity. This committee presented a firm commitment to the position that individual actions, attitudes, outlooks, and preferences inhibit the creation of effective water treatment operator training programs. They further expressed the collective opinion that neither the federal government, the local governments, nor the individual utilities would continue to provide effective, on-going, long range, and cost-effective training. At best the most realistic governmental level capable of fulfilling the treatment managers' and operators' needs would be the state.

As a direct outgrowth of such futuristic thinking, the committee strongly promoted the establishment of a
training committee office or a full-time staff member to act as a coordinator in each state and province of Canada. This officer would coordinate individual, local, and federal programs. In conjunction with the performance of his/her job responsibilities, he/she should belong to a state or provincial training advisory board on certification.

The representatives sitting on this board should represent academic/vocational educational institutions, state boards of certification, water treatment regulatory agencies, and water utilities. These proposed state training committees/coordinators would further act to insure dissemination and evaluation of continuing education and special seminar courses. He/she would administer/monitor correspondence courses and other types of in-service activities. A vigorous and viable system for the evaluation of training needs and the quality control of training opportunities is paramount.

The training committee condoned the utilization of the "CEU value system" for classifying/cataloging training courses. This system should theoretically provide fixed criteria for credit references in water treatment operator training, encourage uniformity, and provide the basis for the necessary quality control programs. The coordinator would serve as: (a) the "key" contact person on matters pertaining to training
courses, (b) the authority who controls the establish­
ment of training programs, (d) the authority who establishes
the criteria to sanction training programs, (e) the
authority who would deny the establishment of inade­
quately prepared/organized training programs.

Michigan does have a training coordinator (A.B.C.
Directory, 1977) whose office is located within the
Michigan Department of Public Health's facilities in
Lansing, Michigan. His name is Mr. William J. Redman.
His title is that of Training Officer. He presently
sits on the Michigan State Advisory Board on Certification
as one of nine (9) voting members.

The coordinated approach recommended by the Joint
Training Coordinating Committee improves the over-all
concept of in-service training programs by enlarging
the base for financial support, providing greater ed­
ucational resources, establishing more and improve prior­
ities, consolidation of manpower efforts, and improving
the efficiency of monitoring the state and provincial
training activities.

The Joint Training Coordinating Committee's
recommendations for the development of training programs
within each state and province of North America are as
follow (A.B.C. Project, 1976):

1. Identify and inventory the need for train­
ing to increase awareness of the problem
and provide a basis for program development;

2. Develop awareness of employer to these needs and gain support of their employees;

3. Promote expansion of training activities by providing a working relationship and generating interest with the state agencies, local units of A.W.W.A. and W.P.C.F., colleges and vocational training institutions, industry, consulting engineers, and ongoing training programs in related fields;


5. Develop means to motivate and provide incentives for operators to seek training opportunities;

6. Establish criteria for the qualifications of instructors and a method of recognizing the importance of their availability and continuing education;

7. Secure legal mandates and authorizations to assist in implementation of training; and

8. Achieve maximum visibility of the need for training and its values. (p. 6)

Reinforcement of the Joint Training Coordinating Committee's recommendation for the establishment of these independent state and provincial training programs is provided through the review of a national survey of water operators' training programs (A.B.C. Project, 1976):

1. Planning and development of training in many states is not being conducted on a comprehensive basis with all the parties
[water treatment systems] involved;

2. In the majority of states that responded to the survey, training is a "tag-along" of certification, it does not have a legal base to build upon, it suffers from an insufficient quantity of funds, and is a reduced or lower priority in many agencies;

3. Many entities [water treatment systems and state agencies] are pursuing independent courses of action in the provision of training which will result in competitive positions and duplication;

4. There still remains an extensive need for improvement in coordination, advice, expertise, and in promoting interest, support, and participation;

5. Practically every state that responded indicated their interest in receiving assistance in the development of training courses in a broad range of subjects. (p. 3)

Additional findings of this National survey stressed the need for greater state leadership to coordinate training courses, schedules, frequency, duration, credit, evaluation, and analysis of their effectiveness.

In a more recent survey of all the Canadian provinces plus three of the United States (Georgia, Iowa, and Virginia), based upon a review and comparison of their individual certification programs offered for water operating personnel, the pertinent/relevant conclusions were as follow (A.B.C. Project, 1977):

Operating personnel are supportive of change to existing state certification programs provided the change will improve consistency of requirements, protect the integrity of the certification process, be consistent with
the true needs of competent operators, promote the image of the profession, and provide better recognition of the need for career growth opportunities.

Turnover or attrition is a greater problem for programs where the personal effort certification requirements (educational examination) and the renewal requirements (annual fee and continuing education) are minimal or do not exist.

Specific recognition and approval of selected education and training programs with approved assignment of continuing education units (CEUs) and established acceptable experience criteria is essential to the maintenance of quality control in program and administration.

Required continuing education as a condition for renewal of certification places a higher value on the certificate, promotes career growth, and reduces attrition.

Continuing education requirements for certification renewal is essential to insure that all operating personnel have the opportunity for direct upgrade training and to participate in professional growth opportunities. (pp. 7,8)

There is a significant difference between training courses and certification. A training program is composed of an undetermined number of activities. The training program is dependent upon the participation/contributions of several entities. The certification system is self-contained. The certification system is administered/controlled by the state and provincial levels of government.

Training systems are more complex than certification systems and require: (a) input from the
certification boards of criteria for facilities' classification and certificate designations for operators, (b) criteria to establish the basis for instruction, (c) development of materials and methods to facilitate delivery of the required instruction, (d) provision of training through a state system affording control and coordination.

Successful training programs are based upon a comprehensive and aggressive approach or plan that pools all of the state's priorities and water treatment personnel needs, regarding both certification and continued education, that must be met.

Training programs are established to: (a) improve the general educational level of operators, (b) improve the operators' understanding of their job related duties/responsibilities, (c) assist operators in achieving certification, (d) improve the operators' rank, (e) improve the operators' wages, (f) improve the operators' certification status.

The major goal of a training program should be to establish a uniform statewide instructional system. Such a system would be based upon the following objectives: (a) one schedule of courses, (b) specific course offerings at regular annual intervals, (c) similarity of course content, (d) an established format for all course offerings. The benefits to be derived from successful implementation of these objectives would be: (a) increased
operator mobility, (b) academic planning could be achieved by operators, (c) operators could schedule their participation, (d) extension of the program's longevity, (e) the program's credibility would be established.

Duvel, Zigment, et al. (1977) collectively agree that in addressing the needs of operators three types of training programs should be offered. They are: (a) a set of basic courses (designed to introduce operators to the fundamental concepts of treatment technology and to prepare the operator for certification), (b) some advanced courses for operators already certified (designed for skills improvement or advanced certification status), (c) specialized courses for the specific problem areas (including laboratory techniques, data interpretation, pump repair and maintenance, electrical maintenance, etc.).

Another fundamental element responsible for the success or failure of a training program for operators is the quality of instruction. Although instructors have been recruited from all the professional sectors, including: (a) consulting engineers, (b) operators, (c) laboratory technicians, (d) secondary education, (e) college/universites, (f) regulatory agencies; they all should share to some degree three (3) very essential characteristics. These characteristics are: (a) he/she must possess knowledge based on experience gained through actual employment in treatment systems, (b) he/she must
possess and utilize the most effective communication skills, (c) he/she by virtue of either their background (education, training, or experience) must be credible. Post-hoc analyses of operator/participants' evaluations of instructors following the completion of in-service courses could contribute positively to the maintenance of the highest caliber of instruction possible.

As reviewed by Duvel and Zigment, et al. (1977), training programs for operators share the following principal problems:

1. Finding and keeping qualified instructors. The program relies heavily on the instructor for adequate preparation, development of demonstrations, possibly taking field trips, arranging for classrooms and other incidental administrative items... With these aggravations and the ordinary changes in professional and personal activities, it is difficult to maintain a constant cadre of qualified people.

2. Funding and keeping continuing funding. ... Funding mechanisms have generally been fragmented. The three sources of funding - E.P.A. grants, state support and registration fees are dwindling.

3. Being responsive to actual educational requirements of operators. Operators' needs are slowly changing ... the number of people interested in taking the basic educational courses offered ... is gradually diminishing.

4. Finding laboratory facilities which can handle 20 students at 25 locations across the state... This is a task of no small proportion. It is mandatory that demonstrations and actual hands-on experience
be maintained to successfully complete a laboratory course.

5. Servicing sparsely populated areas of the state. These are sections that are commonly serviced by the correspondence instructor. The correspondence mechanism is not entirely satisfactory and we are still searching for ways of getting scattered people together for an actual class.

6. Development of advanced and specialized courses beyond the basic training offered. We are just beginning to develop the mechanisms necessary to meet this demand. We are finding an increase in demand for these types of courses. . . . At present these courses are offered in pockets of vocal demand and at selected universities and community colleges where there is an instructor who has a high level of interest in offering this type of course. We find this type of hit and miss approach insufficient and feel more must be done. (p. 59)

The water utility industry can benefit greatly from these organized training programs and meaningful certification systems. A well conceived plan is one like that utilized and adopted in Ontario, Canada. It was termed the "behavioral-objective approach" to solving training problems. This approach aims primarily at man's interaction with his work and his dynamic working environment. The underlying theme of this approach is the sharing of knowledge and skills that are required by the operator to actually operate the plant. Redekopp and Austin (1971) viewed the "behavioral-objective approach" as satisfying three needs: (a) the basic continuum of
performance of operators will have been defined so as to facilitate the preparation and maintenance of job descriptions, (b) the basic content will have been identified for course/curriculum development and for instructional media selection/design, (c) the conditions and criteria for evaluating the post-training performance (licensing examination) of the operator will have been determined.

According to a study conducted by Fairall (1968), training programs should be properly and purposefully organized. Another finding of the study, as supported by Doddridge (1976), was that on-the-job training offered the following disadvantages:

1. The new entrant's time is wasted. He is ineffective while learning the job, and his output in that job is considerably less than it should be.

2. The waste of his fellow workers' time is considerable when he has to ask them questions and seek their help and guidance.

3. Supervisors and management are distracted from more productive tasks when he has to ask for instructions.

4. Inefficient or wasteful use of the capital equipment at the disposal of the new employee is inescapable during training.

5. Damage to materials and the equipment during the learning period can be costly.

6. There is the cost of high labor turnover. (p. 471)

It is an obvious fact that even the best systems of formal education fall short of affording graduates entering
the field of "water engineering" with a complete reper­
toire of skills necessary to achieve success as employees
in a host of water treatment vocations. Loucks (1965)
states:

The guy who leaves the classroom figuring he
knows about all he needs to know and has a
diploma to prove it, and you have all seen
them, is headed for a rude awakening or for
oblivion. There is the need for real work
experience with real live problems. Then,
for the first time, learning about the physi­
cal world we live in can really get down to
business . . . The formal education pro­
vides important background and serves as the
threshold to professional competence. The
important thing is what happens after the
threshold is passed. (p. 24)

The Legislature of the State of Michigan enacted its
first legislation requiring the certification of water
treatment plant operators in the year 1941. In the twenty­
five (25) year period following that enactment, a total
of 937 water treatment plant operators have been examined
and certified as competent to operate the various classes
of water treatment plants in Michigan.

Since 1941 there has been a steady increase in cert­
ification activities. Fundamental reasons for this trend
were: (a) an increase of approximately 222% in the number
of water supplies utilizing treatment processes, (b) a
growing demand for improved water quality, (c) greater
utilization of surface water sources over insufficient
ground water sources, (d) increased chemical additions to
potable water supplies, (e) an increase in the number of
water treatment systems throughout the state. It is estimated that in the ten (10) year period to follow 1965, approximately one hundred (100) potable water supplies will require added or new treatment techniques (Report on Water Requirements for Municipal Use, 1966).

Through the normal attrition process of death, retirement, promotion, and transfer to other positions, replacement of water treatment personnel by certified technicians will continue to be necessary. As pointed out by the Report on Water Requirements for Municipal Use (1966), more men and women will have to be trained, examined, and certified to adequately satisfy the manpower demands imposed by the waterworks industry in the immediate future.
CHAPTER III
DESIGN OF THE STUDY

The purpose of this chapter is to clarify the method of the study and the procedures used to implement it. The specific areas to be clarified are the questions, variables, sources of data, methods of gathering data, instrumentation, and data analysis for the questions.

Overview of Procedure

Participants in this study were selected from seventy complete water treatment systems in the state of Michigan. Employees within these facilities who had received a water operator's certification of either F-1, F-2, F-3, or F-4 were asked to participate in the study and comprised the sample. The instruments were administered in one phase.

During this phase of the study, the respondents were asked to complete all of the items included in the Water Treatment Operator's Questionnaire. The items covered both the employment aspects of the operator's services and other variables as they relate to in-service training and certification. Responses to these items provided an assessment of the levels of operator certification, training course participation by operators, and employment incentives existing to promote
participation in training courses and in-service activities by operators.

Questions

The following questions were investigated in this study:

1. What is the association between participation in in-service training courses and each of the following other variables?
   a. Age
   b. Educational achievement
   c. Length of employment
   d. Job title
   e. Job location
   f. Professional membership(s)
   g. Classification of the water treatment system
   h. Race
   i. Sex

2. What is the association between participation in in-service training courses and each of the following employment variables?
   a. Level of certification
   b. Number of sanctioned in-service training courses completed
   c. Number of credits/points (CEUs) compiled for completion of sanctioned in-service
training courses
d. Number of sanctioned in-service activities attended
e. Number of points (CEUs) compiled for participation in sanctioned in-service activities
f. Number and types of employment incentives to participate in sanctioned training courses
g. Existence of budgeted allocations to pay for participation in sanctioned in-service activities
h. Training course instructors
i. Water treatment systems' sources of water supply

Variables

The variables examined in this investigation were:

1. The highest level of certification issued to operators by the Michigan Department of Public Health's Advisory Board on Certification.

2. The number of training courses utilized by the operators.

3. The number of post-certification in-service activities utilized by the operators.

4. The number of water treatment systems that provide budgeted allocation/reimbursement for participation in
sanctioned training courses.  

5. The number of water treatment systems that provide budgeted allocation/reimbursement for participation in sanctioned in-service activities.

6. The number of certification employment incentives that exist within the water treatment systems.

7. The classifications of water treatment systems were established by the Safe Drinking Water Act of 1976.

Sources of Data

Population

Inasmuch as the federal government, via the Environmental Protection Agency (Safe Drinking Water Act, 1976), had demonstrated a keen interest in the in-service training of water treatment systems operators, the investigator selected water treatment operators as the population. The population was further delimited as being all the certified water treatment operators employed by complete water treatment systems in Michigan.

Criteria for Sample Selection

The roster of complete water treatment systems was provided by the Michigan Department of Public Health. The sample water treatment systems were selected on the basis of the following criteria:
1. The water treatment system must be a public or private supplier located within the state of Michigan.

2. The water treatment system must employ water treatment operators who possess at least one license from any level of the four F-certification grades/categories.

The sample subjects within each water treatment system were selected on the basis of the following criteria:

1. Each subject must be a licensed water treatment operator who possesses at least one of the four F-grade/category certificates.

2. Each subject must not express opposition to the study.

Description of the Sample

The total number of subjects involved in this study consisted of two hundred ten (210) water treatment operators employed by seventy (70) complete water treatment systems in both the upper and lower peninsulas of Michigan. To protect the anonymity of the subjects, the water treatment systems, and the communities, the actual names of systems and subjects were not included in this report. Instead, the water treatment systems are referred to as such, either collectively or individually. The subjects are referred to as respondents or simply as operators.
Methods of Gathering Data

The data were collected in one phase. This phase consisted of the administration of the Water Treatment Operator's Questionnaire (WTOQ), to the water treatment operators. The questionnaire was divided into two component portions, the Demographic Form and the Employment Form.

In all of the water treatment systems sampled, the administration of the instruments was identical. The researcher met with the state training officer, Mr. William J. Redman, to seek his verbal and written permission for a water treatment system's superintendent to conduct the research. Following an explanation of the nature of the study, each water treatment system's manager/chief plant operator was requested to give his/her approval to allow the study to be conducted.

To initiate the process of data collection, a list of complete water treatment systems was obtained from the Michigan Department of Public Health. The researcher then proceeded to confer by telephone with each of the subject's supervisors. The nature of the study, the requirements of the participants, and the confidentiality of the data were explained to each of the subjects. Three (3) copies of the WTOQ and a stamped, addressed envelope were sent to each supervisor who consented to
participate.

Each supervisor was requested to select three (3) certified operators to complete the WTOQ. One of these operators was to possess the highest F-certification existing within that water treatment system (this person may or may not have been the superintendent or chief plant operator). The second operator was to possess the lowest F-certification existing within that water treatment system. The third operator was to be an operator of the supervisor's choosing. This technique was expected to provide a range of distribution for the population sample.

One week after the WTOQs were distributed, a reminder note was sent to each participating supervisor.

Instrumentation

The instrument used in this investigation was a self-constructed questionnaire. The instrument was titled the Water Treatment Operator's Questionnaire (WTOQ). This type of research instrument has the following positive characteristics, according to Hillway (1956):

1. The questionnaire is an efficient means of obtaining facts and details concerning a specific problem or situation.

2. The questionnaire is accepted as one method of obtaining data from people.

3. This survey method provides information for comparison studies.
4. The findings assist in the revealing of trends.

5. Tabulation of data is relatively easy. (p. 189) Kerlinger (1973) further supports the use of questionnaires for their positive advantages of: (a) being economical, (b) being relatively easy to administer over a large geographical area, (c) being speedy, and (d) encouraging respondents (if anonymous) to be honest and frank.

This self-reporting instrument was administered to the men and women who serve as treatment plant operators, chief treatment plant operators, managers, or superintendents within complete water treatment systems in the state of Michigan.

Data Analysis for the Questions

The methods of analyzing data were determined according to the questions developed and the data which were derived therefrom.

The percentage and/or frequency were used to analyze the data regarding preference of instructors, educational achievement, length of employment, level of certification, source of water, and the completion of sanctioned training courses.

The source of data regarding other variables was the Demographic Information Form.
The source of data regarding employment variables was the Employment Information Form.
CHAPTER IV

FINDINGS OF THE STUDY

The purpose of this chapter is to report the findings of the survey, divided into two major sections, namely: (a) representativeness of respondents and (b) results from the two major areas of investigation. The presentation of the second section is arranged according to the major headings of the two areas, with subheadings as per the individual questionnaire items.

Representativeness of Respondents

The population sample for this survey consisted of three certified water treatment operators possessing filtration certificates and employed in each of the seventy (70) complete filtration treatment systems/facilities in Michigan. Thus, the number of questionnaires initially mailed was 210.

The second mailing, for follow-up purposes, to persons who had not previously responded included 84 questionnaires. The third mailing, for follow-up purposes, to those persons who still had not responded included 57. The total number of questionnaires actually received was 132, or 63% of the total sample. Of the 132 responses, only 121 (58%) were included in the data tabulation and analysis. The difference of 11 was a
because of rejection due to: (a) seven persons reported limited treatment certificates (D-1 or D-4), (b) two persons reported no certification, and (c) two persons who reported no certification were awaiting positive confirmation of their certification examinations.

Table 1 shows the distribution of the questionnaires issued, numbers and percentages of persons who responded, and numbers and percentages of questionnaires used for data analysis from each group.

Results from the Two Major Areas

The purpose of this survey was to compare the perceptions of four groups--F-1 operators, F-2 operators, F-3 operators, and F-4 operators--as to significance of both in-service training and in-service activities in their pursuit of the higher levels of filtration certification (from level 4 up to and including level 1) in treatment systems/facilities in Michigan.

This portion of the chapter reports the results of the percentage and/or mean frequencies for responses to the nine questionnaire items included in the Demographic Information Form.

Percentage and/or Mean Frequencies

Part 1 of this survey requested that respondents answer nine different questionnaire items regarding their...
Table 1
Distribution of Questionnaires Issued
and of Responses Received and Used

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of Questionnaires Issued</th>
<th>Responses Received No.</th>
<th>Responses Used No.</th>
<th>%</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-1</td>
<td>70</td>
<td>35</td>
<td>35</td>
<td>50</td>
<td>100</td>
</tr>
<tr>
<td>F-2</td>
<td>35</td>
<td>23</td>
<td>23</td>
<td>66</td>
<td>100</td>
</tr>
<tr>
<td>F-3</td>
<td>35</td>
<td>36&lt;sup&gt;a&lt;/sup&gt;</td>
<td>36</td>
<td>103</td>
<td>100</td>
</tr>
<tr>
<td>F-4</td>
<td>70</td>
<td>27</td>
<td>27</td>
<td>39</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>210</td>
<td>121</td>
<td>121</td>
<td>58</td>
<td>58</td>
</tr>
</tbody>
</table>

<sup>a</sup>In several treatment systems/facilities the F-3 was the lowest level of operator certification present.
job related backgrounds as certified filtration operators in Michigan.

**Item 1.** Tabulation of the responses to the question, "What is your age?" revealed that the lowest mean age (34) was among the F-4's, while the highest mean age (43) was among the F-1's. The difference in mean from level to level was approximately three years.

Table 2 contains the summary of these data for each level of operator certification.

**Item 2.** Tabulation of the responses to the question, "What is your educational achievement?" revealed that the majority of all levels of certified operators had achieved at least a high school education. The most advanced post-high school achievement was demonstrated by the F-2's with 48% of their operators having completed a community college program. Each level, except the F-3's, had at least 13% of their operators holding Bachelors' Degrees.

Table 3 contains the summary of these data for each level of operator certification.

**Item 3.** Tabulation of the responses to the question, "What is your length of employment (in years) in a water treatment facility?" revealed that the approximate progressive increase in the tenure of operators continued from the F-4's through the F-1's. The F-1's had a mean of two years less tenure than did the F-2's. The lowest mean tenure was 6 years among F-4's and the highest
Table 2
Summary of the Mean Frequencies for the Age of Operators

<table>
<thead>
<tr>
<th>Levels of Certification</th>
<th>Age Range</th>
<th>Responses Received</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-1</td>
<td>27-61</td>
<td>33</td>
<td>43</td>
</tr>
<tr>
<td>F-2</td>
<td>26-57</td>
<td>23</td>
<td>40</td>
</tr>
<tr>
<td>F-3</td>
<td>23-63</td>
<td>36</td>
<td>38</td>
</tr>
<tr>
<td>F-4</td>
<td>19-60</td>
<td>27</td>
<td>34</td>
</tr>
</tbody>
</table>
Table 3
Summary of the Percentage Frequencies for the Educational Achievement of Operators

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses Received</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>High School</td>
<td>18</td>
<td>51%</td>
</tr>
<tr>
<td>Community College</td>
<td>7</td>
<td>20%</td>
</tr>
<tr>
<td>Bachelor's Degree</td>
<td>5</td>
<td>14%</td>
</tr>
<tr>
<td>Master's Degree</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>5a</td>
<td>14%</td>
</tr>
<tr>
<td>High School</td>
<td>9</td>
<td>39%</td>
</tr>
<tr>
<td>Community College</td>
<td>11</td>
<td>48%</td>
</tr>
<tr>
<td>Bachelor's Degree</td>
<td>3</td>
<td>13%</td>
</tr>
<tr>
<td>Master's Degree</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>High School</td>
<td>23</td>
<td>64%</td>
</tr>
<tr>
<td>Community College</td>
<td>6</td>
<td>17%</td>
</tr>
<tr>
<td>Bachelor's Degree</td>
<td>3</td>
<td>8%</td>
</tr>
<tr>
<td>Master's Degree</td>
<td>1</td>
<td>3%</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>8%</td>
</tr>
</tbody>
</table>

(Continued)
Table 3 (Concluded)

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses Received</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>High School</td>
<td>18</td>
<td>68%</td>
</tr>
<tr>
<td>Community College</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td>Bachelor's Degree</td>
<td>4</td>
<td>15%</td>
</tr>
<tr>
<td>Master's Degree</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Other</td>
<td>3</td>
<td>11%</td>
</tr>
</tbody>
</table>

*aChoice number 5's responses represented a combination of incomplete academic endeavors beyond high school.*
was 19 years among F-2's.

Table 4 contains the summary of these data for each level of operator certification.

**Item 4.** Tabulation of the responses to the question, "What is your present job title and/or classification?" revealed that the majority of F-4's and F-3's were plant operators. The F-2's were divided almost equally between the categories of operators and superintendents. The F-1's indicated that a majority of their respondents were superintendents.

Table 5 contains the summary of these data for each level of operator certification.

**Item 5.** The responses to the question, "In what town/city is your water treatment facility located?" were used to verify the respondents' answers to item number 7 regarding the designated classification of their respective treatment system/facility. Each respondent's answers to both items numbered 5 and 7 were consistent with the Michigan Department of Public Health's designations.

**Item 6.** Tabulation of the responses to the question, "How many professional organizations (that are associated with the water works industry) are you a member of?" revealed that a clearly defined majority of F-4's (56%), F-3's (64%), and F-2's (83%) who responded each possessed single professional memberships. Although there was no
Table 4
Summary of the Mean Frequencies for the Tenure of Operators

<table>
<thead>
<tr>
<th>Levels of Certification</th>
<th>Tenure Range</th>
<th>Responses Received</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-1</td>
<td>3-40</td>
<td>35</td>
<td>17</td>
</tr>
<tr>
<td>F-2</td>
<td>1-30</td>
<td>23</td>
<td>19</td>
</tr>
<tr>
<td>F-3</td>
<td>1-29</td>
<td>36</td>
<td>8</td>
</tr>
<tr>
<td>F-4</td>
<td>1-23</td>
<td>27</td>
<td>6</td>
</tr>
</tbody>
</table>
Table 5
Summary of the Percentage Frequencies for the Title/Classification of Operators

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses Received No.</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Superintendent</td>
<td>18</td>
<td>F-1</td>
</tr>
<tr>
<td>Manager</td>
<td>2</td>
<td>F-1</td>
</tr>
<tr>
<td>Chief Plant Operator</td>
<td>2</td>
<td>F-1</td>
</tr>
<tr>
<td>Operator</td>
<td>3</td>
<td>F-1</td>
</tr>
<tr>
<td>Other</td>
<td>10^a</td>
<td>F-1</td>
</tr>
</tbody>
</table>

| Superintendent                 | 10                      | F-2                     |
| Manager                        | 0                       | F-2                     |
| Chief Plant Operator           | 3                       | F-2                     |
| Operator                       | 9                       | F-2                     |
| Other                          | 1                       | F-2                     |

| Superintendent                 | 5                       | F-3                     |
| Manager                        | 1                       | F-3                     |
| Chief Plant Operator           | 2                       | F-3                     |
| Operator                       | 27                      | F-3                     |
| Other                          | 1                       | F-3                     |

(Continued)
Table 5 (Concluded)

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses Received</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Superintendent</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Manager</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Chief Plant Operator</td>
<td>2</td>
<td>7%</td>
</tr>
<tr>
<td>Operator</td>
<td>20</td>
<td>74%</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>19%</td>
</tr>
</tbody>
</table>

*aChoice number 5's responses represented a combination of titles/classifications originating and utilized in individual treatment systems/facilities.*
well defined majority of F-1's possessing more than one professional membership, those who indicated dual or multiple memberships comprised a higher percentage (40%) than those who indicated a single professional membership (34%).

Table 6 contains the summary of these data for each level of certification.

Item 7. Tabulation of the responses to the question, "What is the classification assigned to your water treatment system/facility?" revealed that the majority of F-4's, F-3's, and F-1's were employed in Class I systems/facilities (each serving a population between 4,000 and 20,000 customers).

Table 7 contains the summary of these data for each level of operator certification.

Item 8. Tabulation of the responses to the question, "What is your ethnic origin?" revealed that the overwhelming majority of respondents, regardless of their level of certification, belong to the Caucasian race.

Table 8 contains the summary of these data for each level of operator certification.

Item 9. Tabulation of the responses to the question, "What is your sex?" revealed that in each level of certification except the F-4's men comprised 100% of the sample.
Table 6
Summary of the Percentage Frequencies for the Number of Professional Memberships held by Operators

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses Received No.</th>
<th>%</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>12</td>
<td>34%</td>
<td>F-1</td>
</tr>
<tr>
<td>2</td>
<td>14</td>
<td>40%</td>
<td>F-1</td>
</tr>
<tr>
<td>3</td>
<td>3</td>
<td>9%</td>
<td>F-1</td>
</tr>
<tr>
<td>4</td>
<td>1</td>
<td>3%</td>
<td>F-1</td>
</tr>
<tr>
<td>more than 4</td>
<td>0</td>
<td>0%</td>
<td>F-1</td>
</tr>
<tr>
<td>none</td>
<td>5a</td>
<td>14.3%</td>
<td>F-1</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses Received No.</th>
<th>%</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>19</td>
<td>83%</td>
<td>F-2</td>
</tr>
<tr>
<td>2</td>
<td>3</td>
<td>13%</td>
<td>F-2</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0%</td>
<td>F-2</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>0%</td>
<td>F-2</td>
</tr>
<tr>
<td>more than 4</td>
<td>0</td>
<td>0%</td>
<td>F-2</td>
</tr>
<tr>
<td>none</td>
<td>1</td>
<td>4%</td>
<td>F-2</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses Received No.</th>
<th>%</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>23</td>
<td>64%</td>
<td>F-3</td>
</tr>
<tr>
<td>2</td>
<td>1</td>
<td>3%</td>
<td>F-3</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>0%</td>
<td>F-3</td>
</tr>
</tbody>
</table>

(Continued)
Table 6 (Concluded)

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses Received No.</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>F-3</td>
</tr>
<tr>
<td>more than 4</td>
<td>0</td>
<td>F-3</td>
</tr>
<tr>
<td>none</td>
<td>12</td>
<td>F-3</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>1</td>
<td>15</td>
<td>F-4</td>
</tr>
<tr>
<td>2</td>
<td>0</td>
<td>F-4</td>
</tr>
<tr>
<td>3</td>
<td>0</td>
<td>F-4</td>
</tr>
<tr>
<td>4</td>
<td>0</td>
<td>F-4</td>
</tr>
<tr>
<td>more than 4</td>
<td>1</td>
<td>F-4</td>
</tr>
<tr>
<td>none</td>
<td>11</td>
<td>F-4</td>
</tr>
</tbody>
</table>

*The category of "none" as a response was added through necessity of the answers supplied by the respondents.*
Table 7
Summary of the Percentage Frequencies for the Classification of Operators' Treatment Systems/Facilities

<table>
<thead>
<tr>
<th>Plant Classification</th>
<th>Responses Received No.</th>
<th>%</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>19</td>
<td>83%</td>
<td>F-1</td>
</tr>
<tr>
<td>II</td>
<td>5</td>
<td>14%</td>
<td>F-1</td>
</tr>
<tr>
<td>III</td>
<td>1</td>
<td>3%</td>
<td>F-1</td>
</tr>
<tr>
<td>IV</td>
<td>0</td>
<td>0%</td>
<td>F-1</td>
</tr>
<tr>
<td>I</td>
<td>8</td>
<td>35%</td>
<td>F-2</td>
</tr>
<tr>
<td>II</td>
<td>12</td>
<td>52%</td>
<td>F-2</td>
</tr>
<tr>
<td>III</td>
<td>3</td>
<td>13%</td>
<td>F-2</td>
</tr>
<tr>
<td>IV</td>
<td>0</td>
<td>0%</td>
<td>F-2</td>
</tr>
<tr>
<td>I</td>
<td>21</td>
<td>58%</td>
<td>F-3</td>
</tr>
<tr>
<td>II</td>
<td>8</td>
<td>22%</td>
<td>F-3</td>
</tr>
<tr>
<td>III</td>
<td>7</td>
<td>20%</td>
<td>F-3</td>
</tr>
<tr>
<td>IV</td>
<td>0</td>
<td>0%</td>
<td>F-3</td>
</tr>
</tbody>
</table>

(Continued)
<table>
<thead>
<tr>
<th>Plant Classification</th>
<th>Responses Received No.</th>
<th>%</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>I</td>
<td>14</td>
<td>52%</td>
<td>F-4</td>
</tr>
<tr>
<td>II</td>
<td>9</td>
<td>33%</td>
<td>F-4</td>
</tr>
<tr>
<td>III</td>
<td>4</td>
<td>15%</td>
<td>F-4</td>
</tr>
<tr>
<td>IV</td>
<td>0</td>
<td>0%</td>
<td>F-4</td>
</tr>
</tbody>
</table>
Table 8  
Summary of the Percentage Frequencies for the Ethnic Origin of Operators

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses Received No.</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oriental</td>
<td>0</td>
<td>F-1</td>
</tr>
<tr>
<td>Native American</td>
<td>7 (20%)</td>
<td>F-1</td>
</tr>
<tr>
<td>Caucasian</td>
<td>23 (80%)</td>
<td>F-1</td>
</tr>
<tr>
<td>Negro</td>
<td>0 (0%)</td>
<td>F-1</td>
</tr>
</tbody>
</table>

(Continued)
Table 8 (Concluded)

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses Received</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>No.</td>
<td>%</td>
</tr>
<tr>
<td>Oriental</td>
<td>0</td>
<td>0%</td>
</tr>
<tr>
<td>Native American</td>
<td>3</td>
<td>11%</td>
</tr>
<tr>
<td>Caucasian</td>
<td>23</td>
<td>85%</td>
</tr>
<tr>
<td>Negro</td>
<td>1</td>
<td>4%</td>
</tr>
</tbody>
</table>

\textsuperscript{a}\textit{It is possible this term was misunderstood. It was intended to refer to American Indian.}
Table 9 contains the summary of these data for each level of operator certification.

Related Data

This portion of the chapter reports the results of the responses to questionnaire items included in the Employment Information Form.

**Items 3, 6, and 7.** The responses to these questions regarding the completion of sanctioned training courses provided the necessary figures to measure: (a) the number of CEUs achieved by operators, (b) the absence or presence of incentives or benefits for operators, (c) the number of incentives or benefits utilized by operators.

Table 10 contains the summary of the responses to these three questionnaire items.

**Items 5, 6, and 8.** The responses to these questions regarding the completion of sanctioned in-service activities provided the data necessary to measure: (a) the number of CEUs achieved by operators, (b) the absence or presence of incentives or benefits for operators, (c) the number of incentives or benefits utilized by operators.

Table 11 contains the summary of the responses providing these data.

**Item 1.** Tabulation of the responses to the question, "What is your present level of certification?" revealed that, of the total 121 respondents: (a) 29% were F-1
### Table 9

**Summary of the Percentage Frequencies for the Sex of Operators**

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses Received</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>35 100%</td>
<td>F-1</td>
</tr>
<tr>
<td>Female</td>
<td>0 0%</td>
<td>F-1</td>
</tr>
<tr>
<td>Male</td>
<td>23 100%</td>
<td>F-2</td>
</tr>
<tr>
<td>Female</td>
<td>0 0%</td>
<td>F-2</td>
</tr>
<tr>
<td>Male</td>
<td>36 100%</td>
<td>F-3</td>
</tr>
<tr>
<td>Female</td>
<td>0 0%</td>
<td>F-3</td>
</tr>
<tr>
<td>Male</td>
<td>25 93%</td>
<td>F-4</td>
</tr>
<tr>
<td>Female</td>
<td>2 7%</td>
<td>F-4</td>
</tr>
</tbody>
</table>
Table 10

The Total CEUs and Employment Incentives
Received/Available to Operators Completing
Sanctioned Training Courses

<table>
<thead>
<tr>
<th>Description</th>
<th>Several</th>
<th>None</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of CEUs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-1</td>
<td>14</td>
<td>21</td>
<td>35</td>
</tr>
<tr>
<td>F-2</td>
<td>17</td>
<td>6</td>
<td>23</td>
</tr>
<tr>
<td>F-3</td>
<td>26</td>
<td>10</td>
<td>36</td>
</tr>
<tr>
<td>F-4</td>
<td>12</td>
<td>15</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td>69</td>
<td>52</td>
<td>121</td>
</tr>
</tbody>
</table>

| Number of Incentives Utilized |         |      |       |
| F-1         | 22      | 13   | 35    |
| F-2         | 9       | 14   | 23    |
| F-3         | 12      | 24   | 36    |
| F-4         | 7       | 20   | 27    |
| Total       | 50      | 71   | 121   |

| Provisions for Incentives | Yes | No | Total |
| F-1          | 34  | 1  | 35    |
| F-2          | 22  | 1  | 23    |

(Continued)
Table 10  (Concluded)

<table>
<thead>
<tr>
<th>Description</th>
<th>Several</th>
<th>None</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provisions for</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incentives</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-3</td>
<td>33</td>
<td>3</td>
<td>36</td>
</tr>
<tr>
<td>F-4</td>
<td>24</td>
<td>3</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td>113</td>
<td>8</td>
<td>121</td>
</tr>
</tbody>
</table>
Table 11
The Total CEUs and Employment Incentives Received/Available to Operators Completing Sanctioned In-Service Activities

<table>
<thead>
<tr>
<th>Description</th>
<th>Several</th>
<th>None</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of CEUs</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-1</td>
<td>13</td>
<td>22</td>
<td>35</td>
</tr>
<tr>
<td>F-2</td>
<td>14</td>
<td>9</td>
<td>23</td>
</tr>
<tr>
<td>F-3</td>
<td>14</td>
<td>22</td>
<td>36</td>
</tr>
<tr>
<td>F-4</td>
<td>9</td>
<td>18</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td>50</td>
<td>71</td>
<td>121</td>
</tr>
</tbody>
</table>

| Number of Incentives Utilized |         |      |       |
| F-1         | 22      | 13   | 35    |
| F-2         | 9       | 14   | 23    |
| F-3         | 12      | 24   | 36    |
| F-4         | 7       | 20   | 27    |
| Total       | 50      | 71   | 121   |

| Provisions for Incentives | Yes | No | Total |
| F-1         | 33  | 2   | 35    |
| F-2         | 18  | 5   | 23    |

(Continued)
Table 11 (Concluded)

<table>
<thead>
<tr>
<th>Description</th>
<th>Several</th>
<th>None</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Provisions for Incentives</td>
<td>Yes</td>
<td>No</td>
<td>Total</td>
</tr>
<tr>
<td>F-3</td>
<td>30</td>
<td>6</td>
<td>36</td>
</tr>
<tr>
<td>F-4</td>
<td>20</td>
<td>7</td>
<td>27</td>
</tr>
<tr>
<td>Total</td>
<td>101</td>
<td>20</td>
<td>121</td>
</tr>
</tbody>
</table>
operators, (b) 19% were F-2 operators, (c) 30% were F-3 operators, (d) 22% were F-4 operators.

**Item 9.** Tabulation of the responses to the question, "Which type of instructor do you prefer to instruct the sanctioned training course(s) that you attend and participate in?" revealed that in the absence of a majority opinion, F-4's, F-3's, and F-1's favored operators to serve as instructors to teach in-service training courses. The F-2's tended to select professional engineers above all the other choices as the most preferred to teach these courses.

Table 12 contains the summary of these data for each level of operator certification.

**Item 10.** Tabulation of the responses to the question, "What is the source of your water treatment system's/facility's water?" revealed that, at each level of operator certification, lakes and rivers (surface waters) served as sources for more systems/facilities than did wells (ground water).

Table 13 contains the summary of these data for each level of operator certification.
Table 12
Summary of the Percentage Frequencies for Operators' Choice of Instructors for Sanctioned Training Courses

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses No.</th>
<th>%</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Preference</td>
<td>9</td>
<td>26%</td>
<td>F-1</td>
</tr>
<tr>
<td>High School Teachers</td>
<td>0</td>
<td>0%</td>
<td>F-1</td>
</tr>
<tr>
<td>Professors</td>
<td>2</td>
<td>6%</td>
<td>F-1</td>
</tr>
<tr>
<td>Professional Engineers</td>
<td>4</td>
<td>11%</td>
<td>F-1</td>
</tr>
<tr>
<td>Operators</td>
<td>14</td>
<td>40%</td>
<td>F-1</td>
</tr>
<tr>
<td>Other</td>
<td>6a</td>
<td>17%</td>
<td>F-1</td>
</tr>
</tbody>
</table>

(Continued)
Table 12 (Concluded)

<table>
<thead>
<tr>
<th>Choices</th>
<th>Responses No.</th>
<th>Responses %</th>
<th>Levels of Certification</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Preference</td>
<td>10</td>
<td>28%</td>
<td>F-3</td>
</tr>
<tr>
<td>High School Teachers</td>
<td>4</td>
<td>11%</td>
<td>F-3</td>
</tr>
<tr>
<td>Professors</td>
<td>3</td>
<td>8%</td>
<td>F-3</td>
</tr>
<tr>
<td>Professional Engineers</td>
<td>2</td>
<td>6%</td>
<td>F-3</td>
</tr>
<tr>
<td>Operators</td>
<td>13</td>
<td>36%</td>
<td>F-3</td>
</tr>
<tr>
<td>Other</td>
<td>4</td>
<td>11%</td>
<td>F-3</td>
</tr>
<tr>
<td>No Preference</td>
<td>8</td>
<td>30%</td>
<td>F-4</td>
</tr>
<tr>
<td>High School Teachers</td>
<td>0</td>
<td>0%</td>
<td>F-4</td>
</tr>
<tr>
<td>Professors</td>
<td>3</td>
<td>11%</td>
<td>F-4</td>
</tr>
<tr>
<td>Professional Engineers</td>
<td>4</td>
<td>15%</td>
<td>F-4</td>
</tr>
<tr>
<td>Operators</td>
<td>10</td>
<td>37%</td>
<td>F-4</td>
</tr>
<tr>
<td>Other</td>
<td>2</td>
<td>7%</td>
<td>F-4</td>
</tr>
</tbody>
</table>

The choice of "Other" included in item 9. provided respondents with an opportunity to enter a combination of selections from the first five as their answer.
Table 13

Summary of the Percentage Frequencies of Water Sources for Operators' Treatment Systems/Facilities

<table>
<thead>
<tr>
<th>Levels of Certification</th>
<th>Ground Water No.</th>
<th>%</th>
<th>Surface Water No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>F-1</td>
<td>10</td>
<td>18%</td>
<td>25</td>
<td>72%</td>
</tr>
<tr>
<td>F-2</td>
<td>4</td>
<td>17%</td>
<td>19</td>
<td>83%</td>
</tr>
<tr>
<td>F-3</td>
<td>7</td>
<td>19%</td>
<td>29</td>
<td>81%</td>
</tr>
<tr>
<td>F-4</td>
<td>8</td>
<td>29%</td>
<td>19</td>
<td>71%</td>
</tr>
</tbody>
</table>

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CHAPTER V

SUMMARY, DISCUSSION OF FINDINGS, CONCLUSIONS, AND IMPLICATIONS

This chapter: (a) provides the reader with a brief description of the purposes and design of the survey, (b) discusses the findings in regard to the previously unstated assumption of operator training, (c) presents the conclusions drawn from the findings, and (d) offers a brief discussion of the implications of the findings.

Summary

Although the Michigan Department of Public Health has provided sanctioned training courses for operators since 1934, there has never been an attempt on any systematic basis to conduct a comprehensive investigation/survey to appraise the usefulness of these courses regarding the certification of water plant operators in Michigan. Several state and national agencies have expressed professional and academic interest in the fulfillment of this task.

Based upon information collected from personal communications with scores of individuals employed by water treatment systems/facilities regarding training courses and operator certification, the consensus was that several variables determine the operator's motivation
to seek and achieve higher levels of certification, namely: 
(a) participation in sanctioned training courses, 
(b) achievement of CEUs for this participation, (c) par-
participation in sanctioned in-service activities, (d) achieve-
tainment of CEUs for this participation, and (e) employment
incentives or benefits received for their participation in
either one or both of these programs. Insofar as could be
learned, these variables have not previously been empiri-
cally tested or statistically substantiated.

Therefore, the intent of this study was to investigate
the validity of these variables by analyzing data gathered
through conducting a systematic survey of those operators
employed within the seventy complete filtration systems/
facilities in Michigan. It was believed that these data
would further provide empirical information to resolve the
question of whether or not the State Health Department's
assumption of operator training was a hypothetical con-
struct or a realistic construct congruent with vocational
settings existing within the potable water treatment
utilities of Michigan.

The specific purpose of this study was to establish
comparisons between levels of operator certification and
the number of sanctioned training courses completed, the
number of CEUs achieved for course completion, the number
of sanctioned in-service activities attended and completed,
the number of CEUs achieved for completing these activities,
and the number of employment incentives available to and utilized by operators who participated in these sanctioned training courses and activities.

The sample from the population represented in this study consisted of 121 operators employed in fifty of the State's seventy complete treatment systems/facilities. The survey was designed to make comparisons between the four state issued and certified license levels for filtration plant operators.

Comparisons were made between the respective levels of certified operators and their responses to the items included in the Demographic Information Form.

Discussion of Findings

General Findings: Demographic Information Form

It was not surprising to find that the F-1's had the highest average operator age of 43, while the F-4's had the lowest average operator age of 34. Early certification and length of employment as an operator were key factors related to this finding.

The highest average level of post-high school academic achievement was registered by the F-2's. Undoubtedly, many of these operators were in preparation for seeking completion of the F-1 level of certification.

It was encouraging to note that among the F-1's,
F-2's, and F-4's slightly over 10% of the operators had completed Bachelor's Degrees.

The finding that the F-2's demonstrated the longest average tenure (19 years) and the F-4's the shortest average tenure (6 years) was not unexpected.

The majority of F-1's were classified as superintendents, while the majority of F-3's and F-4's were classified as operators. This finding was anticipated.

The highest percentage of dual or multiple professional memberships was recorded by the F-1's, while the majority of F-2's, F-3's, and F-4's avowed single professional memberships. The F-4's recorded the highest percentage of operators having no professional affiliation. This finding was expected.

The majority of F-1's, F-3's, and F-4's were employed in treatment systems/facilities classified as being Class I, while the majority of F-2's were employed in treatment systems/facilities classified as being Class II. This finding was not surprising.

The overwhelming majority of all operators belonged to the Caucasian race. This was an expected finding.

The overwhelming majority of all operators was male. This also was an expected finding.

**General Findings: Employment Information Form**

The number of F-1's and F-2's who were survey
respondents was approximately equal. This was not an unexpected finding.

The F-1 operators by class exhibited the highest total percentage of sanctioned training courses completed.

The F-1 operators by class, therefore, exhibited the highest total percentage of CEUs received for their completion of sanctioned training courses.

The F-1 operators by class exhibited the highest total percentage of sanctioned in-service activities attended.

The F-1 operators by class, therefore, exhibited the highest total percentage of CEUs received for their participation in sanctioned in-service activities.

The F-2 operators demonstrated only a slight five percent margin over the F-1 operators to establish the highest total percentage of work related incentives provided for operators by their filtration systems/facilities.

Over ninety percent of operator classes F-1, F-2, and F-3 indicated that their filtration systems/facilities provided them with work-related incentives to enroll in sanctioned training courses.

In excess of seventy percent of all the operator classes indicated that their filtration systems/facilities provided them with work-related incentives to participate in sanctioned in-service activities.
Among F-1's, F-3's, and F-4's opinion favored operators serving as instructors for sanctioned training courses, while the majority of F-2's favored professional engineers serving in the same capacity. This finding was not surprising in light of the higher education level of the F-2's.

The majority of all operators, regardless of certification level, were employed by complete filtration systems/facilities which utilized surface water(s) as a source of their "raw" or untreated water. This was an expected finding.

Conclusions

The F-1 operators had the oldest average age.

Each class of operators included commendable numbers of college graduates.

Operators within the higher levels of certification exhibited work records of longer tenure than did those operators within the lower levels of certification.

The majority of F-1 level operators were water plant superintendents.

The majority of F-4 and F-3 level operators were water plant operators exclusively.

The majority of F-4, F-3, and F-2 level operators reported single professional memberships, while the F-1 level operators reported multiple professional memberships.
The majority of F-4, F-3, and F-1 level operators were employed within Class I type filtration systems/facilities, while the majority of F-2 level operators were employed within Class II type filtration systems/facilities.

The overwhelming majority of operators within each level of certification were Caucasian.

The overwhelming majority of operators within each level of certification were men.

The majority of operators preferred to have other operators instruct both sanctioned training courses and sanctioned in-service activities.

The majority of operators, regardless of certification level, were employed by water treatment systems/facilities utilizing surface water sources or "raw" or untreated water.

Implications

There exists a need for further study regarding the leader style of the water plant manager or superintendent, tenure of operators with their respective managers or superintendents, staff sizes within water plants, the number of pre and post certification CEU credits achieved by operators, effect(s) of labor unions within water plants, and specific work incentives that exist within water plants.

The results of this investigation suggest that the
future trend for operators will be to achieve college
degrees as well as certification from the Michigan
Department of Public Health.

The investigation also demonstrates the greater
value of sanctioned training courses and sanctioned
in-service activities during the pre-certification exami-
nation period than during the post-certification examina-
tion period for plant operators.

The pattern among all operators within all the
participating treatment systems/facilities appears to
remain unchanged. Once individuals obtain the level of
certification required by or within their respective
treatment systems/facilities, the operators have not
demonstrated a great deal of initiative nor motivation to
increase their total of CEUs achieved or earned through
completion of sanctioned training courses or participa-
tion in sanctioned in-service activities.

The following research hypotheses have been suggested
for consideration in future investigations regarding this
study:

1. The higher the level of certification achieved
by operators, the higher the number of sanctioned train-
ing courses completed by those operators.

2. The higher the level of certification achieved
by operators, the higher the number of sanctioned in-
service activities completed by those operators.
3. Regardless of the levels of certification attained by operators, in water treatment systems where employment incentives exist there will be a higher number of CEUs achieved for participation in sanctioned training courses completed by certified operators than in those water treatment systems where employment incentives do not exist.

4. Regardless of the levels of certification attained by operators, in water treatment systems where employment incentives exist there will be a higher number of CEUs achieved for participation in sanctioned in-service activities attended by certified operators than in those water treatment systems where employment incentives do not exist.
REFERENCES


Fairall, R. S., Dollar value of education and training--organized and unorganized costs, Journal of the American Water Works Association, 1968, 60 (11), 1224-1227.


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APPENDIX A

Communications

Approval for Study by the State Office
Introductory Letter to the Water Plant Superintendents
Reminder Notice
Mr. Al Whitfield  
2088 E. Empire, Box 139  
Benton Harbor, Michigan 49022

Subject: Water Supply Survey

Dear Al:

Please be advised that this department has no objection to your questionnaire survey of various water utilities in the State concerning ongoing job training. We would appreciate receiving a copy of the questionnaire form which you propose to use, and if you so desire, we will be glad to add our comments accordingly.

If we can be of any further assistance to you with your study, please do not hesitate to contact us at your convenience.

Very truly yours,

William A. Kelley, P.E.,  
Chief  
Division of Water Supply  
Bureau of Environmental and Occupational Health

By: Michael P. Kovach, P.E.  
Sanitary Engineer

MPK: sw
Dear Sir:

I am seeking your cooperation in the distribution, completion and return of the enclosed questionnaire: Water Treatment Operator's Questionnaire, (WTOQ). This questionnaire has been approved for distribution by the Michigan Department of Public Health. (see letter enclosed in the questionnaire). The time required to complete the questionnaire should only be approximately ten (10) to fifteen (15) minutes.

Would you please select three (3) of your certified operators to complete the WTOQ. One of these operators should possess the highest F-certification existing within your water treatment system. (This person may be you or the chief plant operator) The second operator should possess the lowest F-certification existing within your water treatment system. The third person should be an operator of your choosing.

Please have each respondent complete all of the questions in the questionnaire. For your convenience, I have enclosed a self-addressed envelope in which you may return the questionnaires.

I would like to, at this time, extend to you and your staff my personal thanks and appreciation for all your cooperation and consideration in assisting me to survey the operators of our great state.

Cooperatively,

Alouch Whitfield, II
Dear Operator:

If you have recently mailed the Water Treatment Operator's Questionnaire for operators employed in complete treatment water supply facilities, please disregard this letter.

If you have not completed and mailed the questionnaire in the stamped, self-addressed envelope that was provided, please take 10-15 minutes and do so. Other operators have responded and your responses are just as important.

Cooperatively,

Alouch Whitfield, II

AW: gsc
APPENDIX B

Instrumentation

Description of Questionnaire
Request Form for Results of Study
Demographic Information Form
Employment Information Form
DESCRIPTION OF QUESTIONNAIRE

for

A SURVEY OF IN-SERVICE TRAINING OF WATER TREATMENT SYSTEMS' OPERATORS IN MICHIGAN

This questionnaire is being distributed to obtain data concerning your profession as an operator working in a complete water treatment system/facility in Michigan. These data will be used in a survey study of In-Service Training of Water Treatment Systems' Operators in Michigan.

These data from the W.T.O.Q. (Water Treatment Operator's Questionnaire) will be of vital importance to municipalities, boards, commissions, superintendents, managers, the Michigan Department of Public Health, and the E.P.A. (Environmental Protection Agency.)

Water plant operators are one of the least studied professional groups existing today. We have a meager collection of definitive information on the effectiveness/and or the value of providing sanctioned training courses. Yet, more and more emphasis/pressure is being placed upon the State of Michigan by the E.P.A. to create an even more comprehensive training program designed to accomplish the instruction of water plant operators, both before and especially following their certification.

You can help your profession and the Michigan State Department of Public Health by providing us with your knowledge, comprehensions, feelings, and experiences regarding in-service training/activities that you have attended and or participated in (specifically in Michigan). Please take a few minutes out of your busy schedule to fill out the attached questionnaire.

If you will return the completed questionnaire as soon as possible, the final results should be prepared and compiled by the end of this fall.

Your answers to all questions are voluntary, and will be kept completely confidential. Any information that may tend to identify you will be seen only by the study's staff, and the I.D. number on the cover is to be used for follow-up purposes only.
IN ORDER TO MAINTAIN ANONYMITY AND CONFIDENTIALITY, PLEASE DO NOT WRITE YOUR NAME ON ANY PART OF THIS QUESTIONNAIRE.
If you would like a copy of the results, please indicate below. Cut the bottom portion of the page off along the dotted line and place it in a separate envelope. We do not want your name to be returned with the questionnaire.

(Check one)

( ) No, I do not want a copy of the questionnaire's results.
( ) Yes, I would like a copy of the questionnaire's results.

Your name ______________________________________________
Your address ____________________________________________
City, State, Zip ________________________________________
Part I - DEMOGRAPHIC INFORMATION FORM

The answers to the following questions are needed to assist the investigator with his statistical analyses of the data. This information will be utilized in the development of the first survey question, "What is the relationship between pre-certification participation in in-service training courses and . . . demographic variables?"

These data as well as all of your other responses are strictly confidential, and they will not be seen by anyone other than the investigator.

1. What is your age? (write in your response)

2. What is your educational achievement? (circle the highest level completed)
   (1) High School
   (2) Community College
   (3) Bachelor's Degree
   (4) Master's Degree
   (5) Other (specify) ______________

3. What is your length of employment (in years) in a water treatment facility? (write in your response)

4. What is your present job title/and or classification? (circle one)
   (1) Superintendent
   (2) Manager
   (3) Chief Plant Operator
   (4) Operator
   (5) Other (specify) ______________
5. In what town/city is your water treatment facility located? (write in your response)

_________________________

6. How many professional organizations (that are associated with the water works industry) are you a member of? (circle one)

(1) 1
(2) 2
(3) 3
(4) 4
(5) more than 4 (specify number) ___________________

7. What is the classification assigned to your water treatment system/facility? (circle one)

(1) I
(2) II
(3) III
(4) IV

8. What is your ethnic origin? (circle one)

(1) Oriental
(2) Native American
(3) Caucasian
(4) Negro
(5) Chicano
(6) Latino
(7) Other (specify) ___________________

9. What is your sex? (circle one)

(1) Male
(2) Female
5

Part II - EMPLOYMENT INFORMATION FORM

The next portion of the questionnaire contains questions concerning your job and your participation in in-service programs and or activities.

This information will be utilized in the development of the second survey question, "What is the relationship between pre-certification in in-service training courses and . . . employment variables?"

1. What is your present level of certification? (circle the highest level you hold)
   (1) F-1
   (2) F-2
   (3) F-3
   (4) F-4
   (5) Other (specify) ___________________

2. How many in-service training courses sanctioned by the Michigan Department of Public Health have you completed in Michigan? (circle one)
   (1) 0
   (2) 1-4
   (3) 5-9
   (4) 10-15
   (5) more than 15 (specify number) ___________________

3. How many CEUs (Continuing Educational Units) have you received for having successfully completed the number of in-service training courses given in your response to question number 2 (above)? (circle one)
   (1) 0
   (2) 1-9
   (3) 10-19
3. (4) 20-30  
   (5) more than 30 (specify number) ___________________

4. How many in-service activities sanctioned by the Michigan Department of Public Health have you attended? (circle one)
   (1) 0  
   (2) 1-5  
   (3) 5-10  
   (4) 10-15  
   (5) 15-20  
   (6) more than 20 (specify number) ___________________

5. How many CEUs (Continuing Educational Units) have you received for having participated in the number of in-service activities given in your response to question number 4 (above)? (circle one)
   (1) 0  
   (2) 1-9  
   (3) 10-19  
   (4) 20-30  
   (5) more than 30 (specify number) ___________________

6. List the total number of individual employment incentives or benefits that you received for your participation in the sanctioned training courses. (circle one)
   (1) 0  
   (2) 1-2  
   (3) 3-5  
   (4) 6-8
6. (5) 9-10
   (6) more than 10 (specify number) ________________

7. Does your water treatment system/facility provide you with a budgeted allocation/reimbursement for your attendance and participation in sanctioned training courses conducted in Michigan? (circle one)
   (1) Yes
   (2) No

8. Does your water treatment system/facility provide you with a budgeted allocation/reimbursement for your attendance and participation in sanctioned in-service activities held in Michigan? (circle one)
   (1) Yes
   (2) No

9. Which type of instructor do you prefer to instruct the sanctioned training course(s) that you attend and participate in? (circle one)
   (1) No Preference
   (2) High School Teachers
   (3) Professors
   (4) Professional Engineers
   (5) Operators
   (6) Other (specify) ________________

10. What is the source of your water treatment system's/facility's water? (circle one)
    (1) Well(s)
    (2) River(s)
    (3) In-land Lake (specify) ________________
    (4) Great Lake(s) (specify) ________________
    (5) Other (specify) ______________________
APPENDIX C

Certification Information

Authority for Certification
Rules
Classification of Treatment Systems
Criteria for Certification
AN ACT to protect the public health; to provide for supervision and control over public water supplies; to prescribe the powers and duties of the department of public health; to provide for submission of plans and specifications for waterworks systems and the issuance of construction permits therefor; to provide for the classification of public water supplies and the examination, certification and regulation of persons operating those systems; to provide for continuous, adequate operation of privately owned, public water supplies; to authorize the promulgation of rules to carry out the intent of the act; and to provide penalties.

Sec. 9. (1) The department shall classify water treatment and distribution systems with regard to size, type, location, and other physical conditions for the purpose of establishing the skill, knowledge, and experience that individuals need to maintain and operate the systems effectively.

(4) For individuals meeting the requirements, the department shall issue certificates acknowledging their competency to operate a specified class of waterworks system or portion thereof. The department may suspend or revoke a certificate as specified by rule.

(5) A water treatment and distribution system shall be under the supervision of a properly certified operator as specified in the rules.
Definitions from Rule 103.

(c) "Certificate" means a document which is issued by the department to a person meeting the qualification requirements for operation of a treatment system or for operation or maintenance of a distribution system, or a portion thereof.

(d) "Certified operator" means an operator who holds a certificate.
### Classification of Treatment and Distribution Systems

<table>
<thead>
<tr>
<th>Class</th>
<th>Population</th>
<th>Design Capacity</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Complete Treatment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>F-1</td>
<td>Greater than 20,000</td>
<td>Greater than 5 MGD</td>
</tr>
<tr>
<td>F-2</td>
<td>4,000 to 20,000</td>
<td>2 to 5 MGD</td>
</tr>
<tr>
<td>F-3</td>
<td>1,000 to 4,000</td>
<td>0.5 to 2 MGD</td>
</tr>
<tr>
<td>F-4</td>
<td>Less than 1,000</td>
<td>Less than 0.5 MGD</td>
</tr>
<tr>
<td><strong>Other Treatment</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>D-1</td>
<td>Greater than 20,000</td>
<td>Greater than 5 MGD</td>
</tr>
<tr>
<td>D-2</td>
<td>4,000 to 20,000</td>
<td>2 to 5 MGD</td>
</tr>
<tr>
<td>D-3</td>
<td>1,000 to 4,000</td>
<td>0.5 to 2 MGD</td>
</tr>
<tr>
<td>D-4</td>
<td>Less than 1,000</td>
<td>Less than 0.5 MGD</td>
</tr>
<tr>
<td><strong>Distribution</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>S-1</td>
<td>Greater than 20,000</td>
<td>--------</td>
</tr>
<tr>
<td>S-2</td>
<td>4,000 to 20,000</td>
<td>--------</td>
</tr>
<tr>
<td>S-3</td>
<td>1,000 to 4,000</td>
<td>--------</td>
</tr>
<tr>
<td>S-4</td>
<td>Less than 1,000</td>
<td>--------</td>
</tr>
</tbody>
</table>
Rule 1911. (1) An applicant for a certificate shall submit as part of an application the names of 4 persons, other than relatives, who may be used as references.

(2) Applicants for certification shall be graded in 3 major divisions as follows:

(a) Educational qualifications of the applicant.
(b) Experience qualifications of the applicant.
(c) The written examination.

(4) Criteria used for grading shall be determined by the division subject to the approval of the advisory board, and shall be made available by the department.

Tentative Criteria - Subject to Change

Educational Qualifications are as follows:

<table>
<thead>
<tr>
<th>F-1</th>
<th>D-1</th>
<th>S-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>80</td>
<td>70</td>
<td>70</td>
</tr>
<tr>
<td>F-2</td>
<td>D-2</td>
<td>S-2</td>
</tr>
<tr>
<td>70</td>
<td>60</td>
<td>60</td>
</tr>
<tr>
<td>F-3</td>
<td>D-3</td>
<td>S-3</td>
</tr>
<tr>
<td>60</td>
<td>50</td>
<td>50</td>
</tr>
<tr>
<td>F-4</td>
<td>D-4</td>
<td>S-4</td>
</tr>
<tr>
<td>50</td>
<td>40</td>
<td>40</td>
</tr>
</tbody>
</table>

Points Given

<table>
<thead>
<tr>
<th>8th Grade</th>
<th>B.A.</th>
</tr>
</thead>
<tbody>
<tr>
<td>40</td>
<td>70</td>
</tr>
<tr>
<td>High School</td>
<td>Non-Scientific</td>
</tr>
<tr>
<td>60</td>
<td>Disciplines</td>
</tr>
<tr>
<td>B.S. Degree</td>
<td>Advanced Degree</td>
</tr>
<tr>
<td>80</td>
<td>70</td>
</tr>
<tr>
<td>Eng., Chem.,</td>
<td>or related sciences</td>
</tr>
<tr>
<td></td>
<td></td>
</tr>
<tr>
<td>Advance Degree</td>
<td>90</td>
</tr>
</tbody>
</table>

Experience Qualifications are as follows:

<table>
<thead>
<tr>
<th>F-1</th>
<th>D-1</th>
<th>S-1</th>
</tr>
</thead>
<tbody>
<tr>
<td>60</td>
<td>12</td>
<td>48</td>
</tr>
<tr>
<td>F-2</td>
<td>D-2</td>
<td>S-2</td>
</tr>
<tr>
<td>30</td>
<td>6</td>
<td>24</td>
</tr>
<tr>
<td>F-3</td>
<td>D-3</td>
<td>S-3</td>
</tr>
<tr>
<td>15</td>
<td>3</td>
<td>12</td>
</tr>
<tr>
<td>F-4</td>
<td>D-4</td>
<td>S-4</td>
</tr>
<tr>
<td>6</td>
<td>1</td>
<td>6</td>
</tr>
</tbody>
</table>

Generally each month experience on the job accounts for a point. Some educational points may be substituted for experience. However an applicant for the F-1 exam must have at least 1 year actual experience in an F-1 or F-2 plant.