WATER TREATMENT
"NEED-TO-KNOW" CRITERIA

FORWARD

This guide was created to help trainers, supervisors and operators determine what topics to review while studying for operator certification exams. The guide breaks each exam into numerous topics and indicates the level of knowledge required for each exam.

In 1995-96 a committee of experienced operators and supervisors reviewed the Association of Boards of Certification standard North American "Need-To-Know". From this review several revisions were made to reflect Ontario's operational needs. From the new, revised "Need-To-Know" the committee developed new certification exams.

The following individuals were members of the Water Treatment Exam Review Committee:

Bruce Boland - Waterbru Water & Wastewater Services
Mauro Fabbro - City of Toronto
Brian Gildner - Ministry of the Environment
Jamie Hennigar - Ontario Clean Water Agency
Renee Hornick - Municipality of Chatham-Kent
Viktoria Kopf - City of Toronto
Agnes MacKillop - Ministry of the Environment
Vaughn Martin - Region of Halton
Barry Parker - City of Greater Sudbury
Garry Punt - Ontario Clean Water Agency
Alex Salewski - Ministry of the Environment
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ABOUT THE ASSOCIATION OF BOARDS OF CERTIFICATION

The Association of Boards of Certification (ABC) has been involved in developing water and wastewater operator certification programs, exams and support materials since 1966. ABC is a North American organization with members in 48 states and 9 provinces. Ontario became a full member of ABC in 1986 to support the introduction of the province's voluntary certification program. ABC provides the province with testing services, support materials and expertise from across North America.

Ontario exams are developed with assistance from the ABC and are fully recognized by the ABC. For details on reciprocity of Ontario exams outside of the province, contact the authority responsible for certification in the province/state which you are interested. Be sure to forward a copy of this "Need-To-Know".

INTRODUCTION

Before writing an exam, operators should be aware how each exam is developed. By understanding how the exams are made, it will be easier to study for the exam.

It is important to know that the exams are cumulative. This means that the knowledge required at a lower class is also required at higher classes. For example, a Class IV operator must know all Class IV topics as well as the Class I, II, and III topics. Generally, questions on a Class IV exam will be more difficult than questions on the same topic on lower class exams.

Although the exams are cumulative, each exam will emphasize different topics. For example in the "Processes Module" of Water Treatment exams, Class I will emphasize disinfection systems; Class II will focus on filtration; Class III on coagulation-flocculation; and Class IV on full process/advanced treatment. Some questions dealing with processes normally found in higher Class facilities will be included in lower Class exams. These questions will be asked at a very basic knowledge level. At the top level, a Class IV operator is expected to master all topics. Since each exam emphasizes different topics an operator is not allowed to 'skip' exam levels (i.e. go from a Class I to a Class IV without first going through Class II and III).

Developing fair exams for water operators is a challenge in a province containing relatively simple, small facilities along side large complex ones. Technologies which may be common in one size of facility may be absent in another. However, an operator who holds any Class of water treatment licence may operate in any water treatment system in the province. For this reason even at a Class I level operators will be expected to have a basic level of understanding or awareness in some of the common advanced processes or technologies (i.e. filtration). For this reason some of the questions on the exam may cover processes or technologies not used in the operator's facility. Although the question may not apply to your facility, it will be relevant for many other operators in the province.

The exams which are written in Ontario are similar to those in other provinces and states. Ontario uses the same format (multiple choice), same length (100 questions) and the same source of questions (the ABC question bank). By keeping the exams similar to the industry standard, the marks obtained by Ontario operators will be more readily accepted in other provinces and states.

HOW TO USE THE "NEED-TO-KNOW"

The "Need-to-Know" is designed as an aid for operators and supervisors. It contains three sections to help users determine the topics and level of training required to meet the requirements of certification examinations. The three sections are:

- "**General Exam Modules**", provides a broad overview of the exams (*page 3*).
- "**Detailed Topic Breakdown"**, provides a detailed breakdown of the topics covered on each exam. It also provides an indication of the level of knowledge required for each topic (*pages 6-9*).
- "**Task Analysis"**, provides a further definition of the tasks and knowledge required for each topic at each Class (*pages 14-22*).

Together these three sections will help guide the operator while studying. For more information on study materials and course offerings refer to the booklet entitled **"*Education & Certification Resource Guide for Water & Wastewater Utility Operators***", available free from the Ministry of Environment and Energy's Certification Office.

GENERAL EXAM MODULES

Every exam is divided into 4 different modules. Each module is further divided into topics. Every question on the exam will fit into one of the topics. The 4 different modules are:

General Module: This module includes basic background knowledge and skills which are required by an operator to perform his/her duties. Some of the skills and knowledge may be obtained prior to becoming an operator, in school or at other work experiences. Others will be specific to the water/wastewater industry. This knowledge is applied on a daily basis by the operator to complete his/her job (i.e. arithmetic calculation of chemical feed rates).

Support Systems Module: This module includes the equipment/materials necessary to perform water/wastewater processes. Pumps, compressors and engines are some of the equipment covered. The module also includes conveyance (piping, fittings, valves joints etc.) and measuring and control systems. Operators will be expected to be familiar with the operation and troubleshooting aspects of this equipment. Detailed maintenance of the equipment is not covered in the exam.

Processes Module: This module focuses on the processes involved in water treatment. This module is the main focus for the exams,

requiring the operator to demonstrate knowledge in the day to day operation of the processes at a facility. Included in this module are equipment specific to processes (i.e. chlorinators, filters etc.). Operators will be expected to know how to operate this equipment, its relationship to the overall treatment process and basic troubleshooting. Detailed maintenance of this equipment is beyond the scope of the exams.

***Administration Module**:* This module covers administrative functions which support the on-going operation of a facility. Depending on the class of exam, operators will be expected to demonstrate basic knowledge and understanding of supervision, finance, communication, site security, information systems and emergency response procedures.

Below is a table indicating the percentage of questions in each of the modules.

PERCENTAGE BREAKDOWN FOR EACH EXAM MODULE				
	CLASS I EXAM	CLASS II EXAM	CLASS III EXAM	CLASS IV EXAM
GENERAL MODULE				
GENERAL MATH	10%	5%	0%	0%
SAFETY	10%	5%	5%	3%
APPLIED SCIENCE	10%	10%	5%	5%
SUPPORT SYSTEMS MODULE	17%	15%	15%	13%
PROCESS MODULE	45%	57%	61%	64%
ADMINISTRATION MODULE				
MANAGEMENT	1%	3%	7%	8%
ADMINISTRATION	6%	5%	7%	7%
TOTAL:	100%	100%	100%	100%
PERCENT QUESTIONS REQUIRING ARITHMETIC CALCULATIONS				
CALCULATING	5 - 12%	5 - 12%	10 - 15%	10 - 16%
NON-CALCULATING	90 - 95%	90 - 95%	85 - 90%	85 - 90%

DETAILED TOPIC BREAKDOWN

The above table also indicates the number of questions which require arithmetic calculations. These questions will be scattered throughout the various modules. In Class I and II exams most of the questions will be in the General Module (General Math Section). In higher Classes the questions will be in the Support Systems Module (i.e. pump, chemical feeder questions), the Process Module (i.e. coagulation/ flocculation, disinfection questions), or the Administration Module (i.e. finance questions). Generally the Class III and IV questions which require calculations are more difficult. These questions require problem solving abilities in addition to arithmetic skills.

TASK ANALYSIS

The ***Detailed Topic Breakdown*** lists the skills, knowledge, equipment, processes, laboratory analysis, and administrative components of the operator's job. It is a table containing all of the examination topics. Each topic is also given a 'mastery rating'. This rating will give operators some indication of the level of difficulty for each topic. The mastery ratings are:

***Basic*:** Operators must understand the importance of the topic; and how it relates to the overall operation of the system. Basic terminology and concepts are covered.

***Intermediate*:** Operators must have working or functional knowledge/ skill in the topic.

***Advanced*:** Operators must be able to evaluate the topic and fully understand the interaction of the topic with the overall operation of the system.

Intermediate levels include all *basic* levels. *Advanced* levels include all *intermediate* and *basic* levels.

Most of the topics in the ***Detailed Topic Breakdown*** have footnotes. On pages 11-13 the footnotes provide a more detailed description of the topic. Further detail is provided in the ***Task Analysis***.

The ***Task Analysis*** listings, which follows the ***Detailed Topic Breakdown***, lists the performance objectives for each topic. The performance objectives are broken down into Basic, Intermediate and Advanced levels. These are the same levels of mastery which are listed in the ***Detailed Topic Breakdown***. The ***Task Analysis*** provides operators with greater detail on the learning objectives for each topic.

Using the *Detailed Topic Breakdown* and the *Task Analysis* listings:

The objectives listed in the are used in combination with the topics in the ***Detailed Topic Breakdown***. These will help to define what an operator needs to know in each topic. The ***Detailed Topic Breakdown*** indicates the level of mastery of the exam topics. The ***Task Analysis*** state performance objectives for each topic by the difficulty level (Basic, Intermediate and Advanced).

To successfully complete an ABC examination, an operator must demonstrate knowledge of the ***Task Analysis*** performance objectives for each ***Detailed Topic Breakdown*** topic according to the rating assigned to the topic. Following is an example of how to use the ***Detailed Topic Breakdown*** and ***Task Analysis***.

An operator would like to know what information is required to pass the topic called Hydraulic Concepts on a Class II exam.

1. First the operators should look in the ***Detailed Topic Breakdown*** (the table starting on page 6) for the topic entitled "Hydraulic Concepts".
2. For a Class II exam the rating assigned to Hydraulic *is Intermediate*.
3. The operator must know how to perform all *Intermediate* tasks for Hydraulic Concepts.
4. Next, the operator observes that a number [6] appears after the topic heading. This indicates that a more detailed description of the topic is given at the end of the ***Detailed Topic Breakdown***. The operator turns to page 11 to read the description.
5. The operator now refers to the ***Task Analysis*** section.
6. In the left column of the General Module (page 14) it states that:
   "A: The operator must complete the following performance objectives as indicated":
7. Under Hydraulic Concepts (page 15-16) the *Intermediate* objectives are:
   6.3 Calculate pumping head, pressure head, static head
   6.4 Using hydraulic concepts and terms explain how a pump functions
8. The operator must also meet all of the objectives stated under the *Basic* level:
   6.1 Define basic hydraulic concepts (head, pressure, rate of flow).
   6.2 Explain the movement and properties of liquid under pressure.
9. The operator must be able to meet all of the stated objectives for the topic.

ONTARIO WATER TREATMENT EXAM DETAILED TOPIC BREAKDOWN

GENERAL MODULE			Class I	Class II	Class III	Class IV
100	General Math Section					
101		Basic & Applied Math [1]	Intermediate	Advanced	Advanced	Advanced
102		Units of Expression [2]	Advanced	Advanced	Advanced	Advanced
110	Applied Science Section					
111		Basic & Applied Science [3]	Basic	Intermediate	Advanced	Advanced
112		Public Health Principles [4]	Advanced	Advanced	Advanced	Advanced
113		Electrical Concepts [5]	Basic	Intermediate	Intermediate	Advanced

114		Hydraulic Concepts [6]	Basic	Intermediate	Intermediate	Advanced
115		Maps & Plans [7]	Basic	Intermediate	Intermediate	Intermediate
120	Safety Section					
121		Safety Procedures [8]	Advanced	Advanced	Advanced	Advanced
122		Safety Equipment [9]	Advanced	Advanced	Advanced	Advanced
SUPPORT SYSTEMS MODULE			**Class I**	**Class II**	**Class III**	**Class IV**
201	Electrical Controls [10] / Transformers		Basic	Intermediate	Advanced	Advanced
202	Battery Banks		Basic	Intermediate	Advanced	Advanced
203	Motors [11] / Drives [12]		Intermediate	Advanced	Advanced	Advanced
204	Pumps					
		Centrifugal	Intermediate	Advanced	Advanced	Advanced
		Positive Displacement [13]	Intermediate	Advanced	Advanced	Advanced
		Turbine	Intermediate	Advanced	Advanced	Advanced
		Metering	Advanced	Advanced	Advanced	Advanced
205	Blowers & Compressors [14]		Intermediate	Advanced	Advanced	Advanced
206	Generators [15]		Intermediate	Advanced	Advanced	Advanced
207	Engines [16]		Intermediate	Advanced	Advanced	Advanced
208	Pipes		Intermediate	Advanced	Advanced	Advanced
209	Joints [17]		Intermediate	Advanced	Advanced	Advanced
210	Valves [18]		Intermediate	Advanced	Advanced	Advanced
211	Fittings [19]		Intermediate	Advanced	Advanced	Advanced
212	Cathodic Protection Devices [20] / Corrosion Control [21]		Basic	Intermediate	Advanced	Advanced
213	Hydrants		Intermediate	Intermediate	Intermediate	Advanced
214	Measuring & Control Systems [22]		Basic	Intermediate	Advanced	Advanced
215	Chemical Feeders [23]		Basic	Intermediate	Advanced	Advanced
216	Cross-Connection & Backflow		Intermediate	Advanced	Advanced	Advanced
PROCESSES MODULE			**Class I**	**Class II**	**Class III**	**Class IV**
301	Sources & Characteristics [24]		Basic	Intermediate	Advanced	Advanced
302	Quality Control & Assurance [25]		Advanced	Advanced	Advanced	Advanced
303	Compliance [26]		Advanced	Advanced	Advanced	Advanced
304	Screening		Intermediate	Advanced	Advanced	Advanced
		Well Screens	Advanced	Advanced	Advanced	Advanced
		Intake Ports/Bar Screens	Basic	Intermediate	Advanced	Advanced
		Hand Cleaned Screens [27]	Basic	Intermediate	Advanced	Advanced

	PROCESSES MODULE	Class I	Class II	Class III	Class IV
	Mechanically Cleaned Screens	Basic	Intermediate	Advanced	Advanced
305	Microscreens	Basic	Intermediate	Advanced	Advanced
306	Aeration [28]	Intermediate	Advanced	Advanced	Advanced
307	Coagulation & Flocculation [29]	Basic	Intermediate	Advanced	Advanced
308	Coagulant Aids	Basic	Intermediate	Advanced	Advanced
309	Clarification				
	Presedimentation	Basic	Intermediate	Advanced	Advanced
	Sedimentation Basins	Basic	Intermediate	Advanced	Advanced
	Upflow Solids Contractors	Basic	Intermediate	Advanced	Advanced
	Tube Settlers	Basic	Intermediate	Advanced	Advanced
310	Filtration				
	Rapid Sand	Basic	Advanced	Advanced	Advanced
	Mixed or Multimedia	Basic	Advanced	Advanced	Advanced
	Pressure	Basic	Advanced	Advanced	Advanced
	Diatomaceous Earth	Basic	Basic	Basic	Basic
	Granular Activated Sludge	Basic	Intermediate	Advanced	Advanced
	Slow Sand	Intermediate	Advanced	Advanced	Advanced
	Membrane Technology(s)[30]	Basic	Basic	Intermediate	Advanced
311	Disinfection				
	Gas Chlorinators	Intermediate	Advanced	Advanced	Advanced
	Ozonators	Basic	Intermediate	Advanced	Advanced
	Ammoniators	Basic	Intermediate	Advanced	Advanced
	Ultraviolet Units	Basic	Intermediate	Advanced	Advanced
	Chlorine Dioxide Feeders	Basic	Intermediate	Advanced	Advanced
	Hypochlorinators	Advanced	Advanced	Advanced	Advanced
	Iodinization/Bromine Processors		Basic	Basic	Basic
	Evaporators		Basic	Intermediate	Intermediate
312	Fluoridation	Intermediate	Advanced	Advanced	Advanced
313	Taste & Odour Control				
	Feeders	Basic	Intermediate	Advanced	Advanced
	Aerators/Oxidators	Intermediate	Advanced	Advanced	Advanced
	Contactor Beds	Basic	Intermediate	Advanced	Advanced
314	Storage				

	PROCESSES MODULE	Class I	Class II	Class III	Class IV
	Ground Storage Tanks	Advanced	Advanced	Advanced	Advanced
	Elevated Tanks	Advanced	Advanced	Advanced	Advanced
	Standpipes	Advanced	Advanced	Advanced	Advanced
	Hydropneumatic Pressure Tanks	Basic	Intermediate	Intermediate	Intermediate
315	Chemical Precipitation Softening			Basic	Basic
316	Ion Exchange	Intermediate	Advanced	Advanced	Advanced
317	Iron & Manganese Removal [31]	Basic	Intermediate	Advanced	Advanced
318	Reverse Osmosis		Basic	Intermediate	Advanced
319	Demineralization		Basic	Intermediate	Intermediate
320	Dechlorination	Basic	Intermediate	Advanced	Advanced
321	Colour/Organic Removal	Basic	Intermediate	Advanced	Advanced
322	Recirculation [32]	Basic	Intermediate	Advanced	Advanced
323	Waste Treatment (Sludge Handling) [33]	Basic	Intermediate	Advanced	Advanced

	PROCESSES MODULE	Class I	Class II	Class III	Class IV
326	Laboratory - Plant Process Tests [34]				
	Alkalinity	Intermediate	Advanced	Advanced	Advanced
	Aluminum	Basic	Intermediate	Advanced	Advanced
	Chlorine	Advanced	Advanced	Advanced	Advanced
	Colour	Intermediate	Advanced	Advanced	Advanced
	Fluoride	Advanced	Advanced	Advanced	Advanced
	Iron	Basic	Intermediate	Advanced	Advanced
	Jar Test	Basic	Intermediate	Advanced	Advanced
	pH	Advanced	Advanced	Advanced	Advanced
	Temperature	Advanced	Advanced	Advanced	Advanced
	Total Hardness	Intermediate	Advanced	Advanced	Advanced
	Turbidity (NTU)	Advanced	Advanced	Advanced	Advanced
327	General Lab Tests [35]	Basic	Basic	Intermediate	Advanced
	ADMINISTRATION MODULE	**Class I**	**Class II**	**Class III**	**Class IV**
410	Management				
411	Planning [36]	Basic	Intermediate	Advanced	Advanced

ADMINISTRATION MODULE			Class I	Class II	Class III	Class IV
412		Personnel [37]	Basic	Basic	Advanced	Advanced
413		Finances [38]	Basic	Intermediate	Advanced	Advanced
420	Administration					
421		Maintenance Management [39]	Basic	Intermediate	Advanced	Advanced
422		Information [40]	Basic	Intermediate	Advanced	Advanced
423		Emergency Response [41]	Basic	Intermediate	Advanced	Advanced
424		Public Relations [42]	Intermediate	Advanced	Advanced	Advanced
425		Security [43]	Intermediate	Advanced	Advanced	Advanced

In each exam, certain topics in the Processes Module are emphasized. In the table below the main topics for each class of exam are given. Only topics with at least 2 questions are included. The topics are listed in order of importance. For example on a Class 1 exam there are more questions on Disinfection than questions dealing with Laboratory knowledge. Likewise there are more questions on Storage than there are on Taste & Odour.

PROCESSES MODULE - PRIORITY TOPICS

	CLASS I	CLASS II	CLASS III	CLASS IV
Hi ↕ Number of Questions ↕ Low	_ Disinfection		_ Coagulation & flocculation	_ Filtration _ Coagulation
		_ Filtration	_ Disinfection	_ Disinfection
	_ Laboratory	_ Disinfection _ Laboratory	_ Laboratory _ Compliance	_ Laboratory _ Clarification
	_ Compliance	_ Coagulation & flocculation _ Clarification	_ Filtration _ Clarification	_ Compliance
		_ Compliance		
	_ Storage _ Taste & odour _ Sources & characteristics	_ Taste & odour _ Aeration _ Sources & characteristics	_ Waste treatment _ Colour/organics _ Storage _ Advanced treatment _ Taste & odour _ Sources & characteristics	_ Advanced treatment _ Waste treatment _ Taste & odour _ QA/QC _ Storage _ Colour/organics
	_ Fluoridation _ Screening	_ QA/QC _ Storage _ Screening _ Waste treatment		

ENDNOTES: TOPIC DESCRIPTIONS

The numbers below refer to the topics listed in the above table entitled "**Ontario Water Treatment Exam Detailed Topic Breakdown**" (*pages 6-9*). The below endnotes provide a greater description of the topic, by providing an indication of the equipment and processes involved.

General Module

1 ***Basic and Applied Math*** - Calculating volume, area, flow rates, feed rates, percentages, ratios, squares, cubes, roots, ability to calculate water/wastewater formulas.

2 ***Units of Expression*** - Imperial, metric, conversion between imperial and metric, common metric prefixes.

3 ***Basic & Applied Science*** - Chemistry (common water/wastewater chemicals, chemical reactions, basic chemistry terms: [pH and related concepts, oxidation/reduction, ionization etc], mixtures and solutions) physical properties of liquids, solids and gases.

4 ***Public Health Principles*** - Microbiology (pathogens, nuisance organisms), microbiological testing (coliform testing), drinking water quality parameters, waterborne diseases.

5 ***Electrical Concepts*** - Electrical units (volt, amperes, ohms, watts), electrical circuits, electrical terminology.

6 ***Hydraulic Concepts*** - Rate of flow, pressure, head (static, friction, pressure), pump hydraulics (work, power, horsepower, efficiency).

7 ***Maps and Plans*** - Maps, blue prints, site diagrams, equipment specifications.

8 ***Safety Procedures*** - Occupational Health and Safety Act, WHMIS, owner/operator responsibilities, construction safety, plant safety, electrical safety, infections and infectious diseases, hazardous gases, chemical handling, chemical labels, confined space entry.

9 ***Safety Equipment*** - Personal protection gear, traffic control/public safety (warning devices, barricades), hazard detection, first aid/hygiene, gas detection equipment

Support Systems Module

10 ***Electrical Controls*** - Electrical circuits, circuit testing, fuses, protective devices, circuit breakers, overload relays, motor starters.

11 ***Motors*** - Single Phase, Poly Phase, Variable Speed

12 ***Drives*** - Coupled, Direct (Shaft, Gear), Speed Reducer (Fixed, Variable), Right Angle

13 ***Positive Displacement Pumps*** - Piston Plunger, Progressive Cavity, Diaphragm

14 ***Blowers & Compressors*** - Centrifugal, Positive Displacement (Rotary, Piston)

15 ***Generators*** - AC, DC

16 ***Engines*** - Gasoline, Diesel, Gas

17 ***Joints*** - Flanged, Compression, Dresser, Victaulic, Fused, Threaded

18 ***Valves*** - Ball, Check, Globe, Gate, Plug Petcock, Pressure Control, Vacuum Relief, Aud, Butterfly, Multiport, Telescoping Sluice Gate, Air Release , Foot, Altitude

19 ***Fittings*** - Coupling Union, Plug/Caps, Special

20 ***Cathodic Protection Devices*** - Anode Rod/Bags, Cathode Rod/Bags, Rectifiers, Potentiometers

21 ***Corrosion Control*** - Feeders, reaction basins

22 ***Measuring and Control*** - Signal Generators (Kennison Nozzle, Magnetic Flowmeter, Parshall Flume, Proportional Weir, Rectangular Weir, Venturi, Propeller Meter, Ultrasonic, Pitot Tube), Signal Transmitters (Electric, Pneumatic, Hydraulic, Mechanical, Telemetry), Signal Receivers (Counters, Indicators, Log Scale Indicators, Totalizers, Recorders, Combination Recorders), Meters (Hydraulic-Rotameter, Electrical-Amp, Electrical-Watt [Watt Hour Meter], Electrical-Multitester VOM], Electrical-Megger, Mechanical-RPM), Alarms, Controls (Pneumatic, Float, Hydraulic, Electrical, Telemetry, Timers)

Processes Module

23 ***Chemical Feeders*** - Solids, Liquids, Evaporators, Gas, Slurry

24 ***Sources & Characteristics*** - Characteristics of ground and surface waters, seasonal and daily quality changes, seasonal and daily demands.

25 ***Quality Control & Assurance (QA/QC)*** - Indicators of process/effluent quality, quality control procedures.

26 ***Compliance*** - Ontario environmental legislation affecting water treatment plants, safe drinking water, scope and authority of certificates of approval, owner/operator responsibilities.

27 ***Hand Cleaned Screens*** - Fine mesh, secondary screens

28 ***Aeration*** - Diffused aerators, mechanical aerators-mixer, cascade aerators

29 ***Coagulation & Flocculation*** - Mixer (flash, high speed), air injector/diffuser, hydraulic (static mixer), baffles.

30 ***Membrane Technology(s)*** - Microfiltration, ultrafiltration

31 ***Iron & Manganese Removal*** - Chemical precipitation units, aerators, filter units

32 ***Recirculation*** - Water and sludge recirculation systems

33 ***Waste Treatment*** - Sludge conditioning, sludge drying beds, sludge vacuum filters, sludge filter press, sludge belt press, sludge centrifuges, landfill solids, land application of solids.

Administration Module

34 ***Laboratory - Plant Process Tests*** - Tests routinely conducted on site by operators, often using portable equipment. Includes alkalinity, chlorine residual, colour, fluoride, iron, jar test, pH, temperature, total hardness and turbidity.

35 ***General Lab Tests*** - Lab tests conducted by laboratory technicians (Includes algae, ammonia, biomass, calcium, chloride, coliforms, manganese, nitrate, orthophosphate, particle count, phosphate, specific conductance, sulphate, sulphide, threshold odour number, TOC, total solids), basic understanding of test purpose, acceptable ranges, meaning of lab results.

36 ***Planning*** - Facility planning, decision making.

37 ***Personnel*** - Supervision/management, hiring, disciplining, interviews, communication,

38 ***Finances*** - Budgets, procurement, purchasing, inventory control/management.

39 ***Maintenance Management*** - Maintenance procedures (general),

40 ***Information*** - Record keeping, computer systems, reports.

41 ***Emergency Response*** - Spill response, fire, explosion, bomb threat, natural emergencies, hydraulic overload, slug loads, process failure.

42 ***Public Relations*** - Communication with public, complaint investigation, disclosure of information.

43 ***Security*** - Security of facility and property, prevention of vandalism, theft, security of staff, security of product.

TASK ANALYSIS

General Module