



**WATER ENVIRONMENT ASSOCIATION OF ONTARIO  
(WEAO)**

**PROCESS CONTROL EVENT**

**PRELIMINARY RULES  
PROCESS CONTROL EVENT  
OTTAWA – 2012**

The process control event for the 2012 Operations Challenge will be very similar to previous events with minor rule modifications. The test content and the general layout will be essentially unchanged. The scoring system however has been slightly modified. Details are described below.

**I. OVERVIEW AND EVENT PHILOSOPHY**

The purpose of the Process Control Event is to distinguish the relative process control skills of the teams competing so that points can be awarded proportionately. In an ideal world, this would consist of each team standing before a panel of judges and reciting all their wastewater knowledge and answering questions from the judges. In the context of the Operations Challenge, this is not practical, so a timed written test is used.

Unlike most test situations, it is not expected that all teams will complete the entire exam and finish answering all the questions. The goal of this challenge is not to see who can answer all questions with the fewest mistakes. Instead, teams are given the opportunity to provide as many correct answers as they can in a certain allowed period of time. The test is designed to be long enough so that teams do not run out of questions to answer.

The types of questions and their difficulty level are roughly matched to the points awarded for getting the correct answer. Since the exam is designed to include different types of questions (for example, simple multiple choice questions versus more complex scenario questions), solving the more complex questions will be worth more than the simpler multiple choice questions. It is then up to each team to develop a strategy to figure out which questions to answer in the time allotted to achieve the highest final score.

**II. ABOUT THE TEST**

The test for the Process Control Event consists of answering a number of questions categorized as follows:

- multiple choice word questions
- multiple choice math questions
- operational scenarios questions

Since the test event is timed, it should be viewed as an opportunity for each team to demonstrate their accumulated skills and knowledge of wastewater treatment operations and process control in the shortest time possible. Accordingly, a team can split up the

test any way it chooses during the test. If a team completes the test before the end of the allowed time for the event, their actual time will be recorded.

The time allotted for the entire test event is 30 minutes.

### **1. Questions with Word Multiple Choice**

There will be forty (40) multiple choice word questions. Each will have four (4) possible answers. Generally, there will be only one (1) correct answer for each question. If you believe that more than one answer could be correct, choose (circle) the most correct answer.

In addition, there will be twenty (20) extended multiple choice word questions where the answer to each is chosen from a list of twenty (20) possible answers. There will be only one (1) correct answer for each of these questions.

### **2. Questions with Math Multiple Choice**

There will be ten (10) multiple choice math questions. Each will have four (4) possible answers. These questions will require you to perform a simple mathematical operation that will generally follow a simple one-step formula. There will be only one (1) correct answer for each question.

For each of these questions, your work has to be shown as to how your answer is derived. This will affect your final score as explained later in Section III.

### **3. Questions with Operational Scenarios**

There will be four (4) process scenarios. Each scenario will contain four (4) questions (for a total of sixteen (16) questions). Some of these questions will be text based, while others may require you to perform considerable number of calculations.

As before, for each of the questions that require you to perform a mathematical operation, your work has to be shown as to how you derived your answer. Again, this will affect your final score as explained in Section III below.

## **III. ABOUT THE SCORING**

The scoring for each of the question categories is explained in detail. Make sure you understand how the scoring system works as it will affect your final score and how you as a team develop your strategy towards the test.

## **1. Questions with Word Multiple Choice**

Each of the 40 multiple choice word questions will be assigned a score of one (1) point. There will be only one (1) correct answer for each question. Scoring is described as follows:

- If you choose the right answer, you will be credited with 1 point.
- If you choose the wrong answer, no point will be given.
- If you choose not to answer a question, no point will be given.

Each of the 20 extended multiple choice word questions will be assigned a score of one (1) point. There will be only one (1) correct answer for each question. Scoring is described as follows:

- If you choose the right answer, you will be credited with 1 point.
- If you choose the wrong answer, no point will be given.
- If you choose not to answer a question, no point will be given.

If you answer all questions correctly, the highest possible score will be equal to sixty (60) points.

## **2. Questions with Math Multiple Choice**

Each of the 10 multiple choice math questions will be assigned a score of four (4) points. There will be only one (1) correct answer for each question. Scoring is described as follows:

- If you choose the right answer **AND** you show your complete work as to how the answer was derived, you will be credited with 4 points.
- If you choose the right answer with minimal work shown or incorrect work shown, no points will be given.
- If you choose the right answer but you do not show your work as described above, no points will be given.
- If you choose the wrong answer but you show an attempt to correctly work out the answer, partial credit will be given based on the level of effort shown.
- If you choose the wrong answer with no work shown at all, no points will be given.
- If no answer is chosen, no points will be given.

If you answer all the multiple choice math questions correctly, the highest possible score will be equal to forty (40) points.

## **3. Questions with Operational Scenarios**

Each of the 4 process scenarios will comprise of four (4) questions as described earlier, for a total of sixteen (16) questions. Each of these questions will be assigned a score of

ten (10) points, or a total of forty (40) points per scenario. Scoring is described as follows:

- a) *for those questions that require performing mathematical operations:*
- If you answer correctly **AND** you show your complete work as to how the answer was derived, you will be credited with 10 points.
  - If you answer correctly but only some work is shown (and the work that is shown is correct), you will be credited with 5 points.
  - If you answer correctly but you do not show any work as described above, you will be credited with 3 points.
  - If you answer correctly but you show incorrect steps towards your answer (left to the discretion of the person marking your test), no points will be given.
  - If you answer incorrectly but you demonstrate some knowledge of correctly working out an answer, partial credit will be given based on the level of effort shown, between 2 points and 5 points, left to the discretion of the person marking your test.
  - If you answer incorrectly and you show incorrect steps towards an answer (left to the discretion of the person marking your test), no points will be given.
  - If you answer incorrectly with no work shown at all, no points will be given.
  - If no answer is given, no points will be given.
- b) *for those questions that do not require performing any mathematical operations:*
- If you answer correctly you will be credited with 10 points.
  - If you answer incorrectly, no points will be given.

If you answer all the scenario questions correctly, the highest possible score will be equal to one hundred and sixty (160) points.

#### **4. Important Notes about Scoring**

- 1) For all math questions (both multiple choice and process scenarios), the team must write down all the numbers used and show them in an equation form. Simply putting down numbers will not give you any points. Additionally, any equation used must be relevant to the question. No credit will be given for writing down a formula about volume, for example, when the question is about detention time. Also, all units and conversion factors must be shown. Again, no credit will be given if no units or conversion factors are clearly shown.
- 2) For the process scenario type questions, some answers that are text-based (rather than numbers-based) may still require you to show your mathematical work. For example, if the correct answer for a problem is “*the hydraulic loading rate is too high*” then the work shown must include a calculation of the hydraulic loading rate. In this case, Rule #1 above will apply.

- 3) The person(s) grading the test can only use what the team writes down to determine how they are attempting to solve a mathematical problem. Therefore it is the responsibility of the team members to clearly show how they arrived at an answer. The person(s) grading the test cannot and will not infer missing steps in solving any of the mathematical problems or in verifying any of the answers given without detailed work shown.

## **5. Time Bonus**

The time allotted to complete the test is thirty (30) minutes. Teams are encouraged to utilize the entire time allowed to complete the test. However, if a team completes the test before twenty (20) minutes, a bonus of forty (40) points will be awarded. There will be no bonus points awarded if the test is completed after the 20 minutes but before the 30 minutes.

Based on the above, it is up to a team to decide whether to maximize the number of questions answered within the 30 minutes period (thus maximizing their possible score), or to forfeit their exam before the end of the 20 minutes in order to gain an additional 40 points.

## **6. Final Score**

In accordance with the above rules

- the highest score possible for the test without the time bonus is 260 points
- the highest score possible for the test with the time bonus is 300 points.

A team's final score will be the sum of all points accumulated for each of the categories plus the time bonus (if any). The team with the highest score will win the Process Challenge Event.

## **IV. ABOUT THE TOPICS**

Questions on the test will cover many diverse topics related to wastewater operations. Some topics will be general in nature (such as pumping, metering, flow measurement, piping, maintenance, safety, electrical, etc.). Other topics will be more specific to operations of various types of wastewater plants (conventional versus extended aeration versus SBRs versus trickling filters, etc., preliminary treatment, primary and secondary clarification, control of the activated sludge process, mathematical control applications, troubleshooting problems, microscope work and applications, chemical relationships and applications, disinfection, sludge digestion, sludge handling and management, etc.).

With respect to the questions specifically pertaining to operational scenarios, the focus will be on details pertaining to the activated sludge process. Teams are encouraged to focus their attention on basics, details, and troubleshooting techniques.

## V. ABOUT RESOURCES

Many study material and technical references are available at your disposal. The following is a general list (but by no means a complete one). Teams are encouraged to research additional study material as they see appropriate.

- *Manual of Practice 11*; Water Environment Federation
- *Operations of Wastewater Treatment Plants – Volumes 1 & 2*; California State University Sacramento
- *Advanced Waste Treatment*; California State University Sacramento
- *Operations and Maintenance of Wastewater Collections Systems*; California State University Sacramento
- *Manual on the Causes and Control of Activated Sludge Bulking and Foaming*; Jenkins, Richards & Daigger
- *Wastewater Engineering – Treatment, Disposal, and Reuse*; Metcalf and Eddy; McGraw-Hill
- The WEF/ABC study guide
- The monthly Water Environment & Technology Operations Forum WEF Skills Builder quiz – <http://www.wef.org/ConferencesTraining/SkillsBuilder/>
- Questions on Operations Central Certification Quiz on the WEF website
- EPA design manuals, which can be obtained at <http://www.epa.gov/ttnrmrl> (select Browse to see the full list of available documents; only some are applicable to wastewater)

Note that some of these sources will not be used in creating or grading the test. They are listed for those interested in additional sources of information pertaining to wastewater treatment and operations.

## **VI. ADDITIONAL RULES AND DETAILS**

- All team members must be present at least 10 to 15 minutes before the start of the event.
- Judges will not have any study material or reference books available at the event. If you need to review any material before the test, plan on bringing your own material as needed. The use of reference books or any other study material during the test event is not permitted.
- Answer sheet forms and scratch paper for calculations will be supplied prior to the test.
- Competitors must supply their own writing utensils and calculators. Calculators cannot have programming or printout capabilities.
- Teamwork in solving any part of the exam is highly encouraged. As such, team members may talk among themselves during the test, but may not be disruptive to others in the room. Any disruptive activities will be a cause for disqualification.
- If a judge determines that a team member is not attempting to help his team with parts of the test, a 50 point penalty will be assessed for each non-participating team member.
- If a team is disqualified from the event (caught cheating or being disruptive), they will receive a score based on the maximum time with every question left blank and no work shown.
- Process Control Event committee members will be available to discuss the test's scoring scheme prior to the test, but not after the test.
- All mathematical questions on the test will be in metric.
- Formula sheets and conversion factors will not be provided.

Should you have any questions regarding any of the above, please contact Hany G. Jadaa at [lexicon@ca.inter.net](mailto:lexicon@ca.inter.net)