

WEFTEC 2020

Rules: Virtual Process Control Event

The process control event for the 2020 Operations Challenge will be fully virtual and will consist of two computer-based components; the simulator with both steady-state and dynamic process questions as well as the newly developed multiple-choice portion, taking the place of the previous hand-written multiple choice questions. These two components of the event need to be completed within the overall event duration of 30-minutes. Similar to the previous practice version provided, both the multiple-choice and process simulator portions of the event will be made available in advance for download on a computer provided by each team. Use of either portion of the event will be restricted by an access code that will be provided just prior to the event. The computer used for the software download and during the event needs to be connected to the internet so that each team's score is transmitted to Hydromantis.

Overview

Teams will perform two portions of the Process Control Event:

1. Electronic multiple-choice questions completed on a computer, Duration=10 minutes.
2. Process simulation questions completed on a computer, Duration = 15 minutes.

The two portions of the event will occur sequentially, on the same computer. Each will be timed events but the order in which these two portions of the event are completed can be at the discretion of the team. However, both components will need to be completed within the overall time allotted for the event. In addition to the timed duration of each portion of the event, there will be 5 minutes of "spare" time within the overall event duration of 30 minutes to allow the teams to transition between the two portions of the event.

Scores for each portion of the event will be automatically recorded upon clicking on the "Submit" button but we ask that after each portion of the event is completed, the teams photograph their computer screen with the summary scores of each portion of the event and email the photos to the Process Control Event Coordinator at pdombrowski@woodardcurran.com. This will serve as the Team Captain's acknowledgement of the score recorded by the software.

1. Computer-based Multiple-Choice Questions and Procedures

New for 2020 will be a computer-based electronic multiple-choice questions. The multiple-choice questions will be of a similar nature as the simple multiple-choice questions included in previous Operations Challenge events and there will be no extended, matching multiple-choice questions. A practice multiple-choice test is included with the simulator download available from the Rocky Mountain WEA Operations Challenge website.

The multiple-choice portion of the event will be 10-minutes in duration and can be completed by the team members either before or after the Process Simulator portion of the event. Similar to the simulator portion of the event that has been included previously, the team member completing the multiple-choice questions must enter the team name and number before starting the event. Once the “Start” button is selected, a 10-minute countdown timer begins, and the team can work through the problems by clicking on the best answer possible for each. After completing all the questions possible, the “Submit” button must be pressed prior to expiration of the countdown timer. After clicking “Submit”, a popup box will display the team score for this portion of the event. Do not close this box until the end of the event so that the score can be photographed and submitted to the Event Coordinator. If the multiple-choice portion of the event is completed first, simply minimize the popup box and proceed to the Process Simulator portion of the event.

Note that only 1 attempt is allowed for the multiple-choice portion of the event. Once the answers are submitted, the questions will no longer be available to edit. **Also, you must press “Submit” prior to end of the 10-minute duration of the multiple-choice portion of the event to receive credit.**

2. Process Simulator

The Process Simulator is a treatment plant software model created by Hydromantis. The user interface is designed so that operators start with an overview of a plant layout and a series of process questions. Starting from the Main Menu, each question will have a description and the performance objectives needed to solve that problem. These performance objectives are typically related to effluent performance but may also include process operating conditions, as well as chemical and energy costs. Competitors can then open windows to change operational controls and view data for various unit processes. They can adjust aeration, pump settings, chemical feed rates and even the number of units in service. Note that in some problems, units may start the simulation as out of service or chemical addition may be on at the start of the problem that will need to be turned off. There may also be some unit processes that are out of service and cannot be used for a particular problem. Essentially the simulator allows operators to see data and adjust plant operations just as they would in real life.

There are 10 steady state questions and 1 dynamic question in the 2020 event. The computer run time for the steady state questions is typically only a few seconds each but the run time for the dynamic question (#11) is typically between 90 and 120 seconds and will be nearly identical in duration on every computer.

Each of the steady state questions will have from 2 to 5 objectives to meet and there will be 25 points awarded for each objective correctly answered (question point totals ranging from 50-125 points). The dynamic question will have a simulated run time of 5 days and points are

awarded only if the parameter (i.e., TSS) is met for the entire 5-day simulation run time. The points for meeting effluent targets for each parameter for the full 5-day period during the dynamic event is 100 points (300 points for all 3 questions).

Each team will have up to 15 minutes to achieve as many process objectives as they can. The software will display points as objectives are met as well as the time remaining. At the end of the allotted time the simulator will stop and display the points earned. Note that points will be awarded for each problem objective met but only if the question answer has been submitted during the 15-minute time limit. **Remember, that if you do not press the submit button on a question, no points will be recorded for your score.**

Process Simulator Procedures

The layout of the process simulator will be consistent with the previous practice and WEFTEC competition versions of the software. No further details on the questions will be provided prior to the event.

After logging in to the simulator, a 15-minute timer starts, and a menu of the questions is presented. Teams can choose any question and begin studying the initial conditions and current outputs. Then they make as many adjustments as desired and update the simulation. An update to the steady state questions will take a few seconds and present new results. The team can repeat the adjustments and results as many times as desired. Goals will be highlighted as they are achieved. A team can move to a different question before all goals are achieved if they wish. They will earn points only for the goals achieved and SUBMITTED. The software doesn't allow returning to the exact point where a scenario was left, so some of the prior changes made will need to be re-entered. In the time provided the team will complete as many question objectives as possible. The time remaining will show continuously in the middle of the screen.

Event Philosophy

The purpose of the Process Control event is to distinguish the relative process control skills of the teams 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, the expectation is not that all teams will complete all the questions. The goal 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 the allowed time. The test is designed to be long enough so that teams should not run out of questions to answer.

The types and difficulty levels for questions are roughly matched to the points awarded for getting the correct answer. Solving the more difficult process simulator questions are usually worth more than the quick multiple choice questions. It is 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.

Unlike previous Process Control Events, there will be no partial credit possible on any of the questions.

Grading

The tests will be graded as follows:

- Electronic multiple-choice questions as: correct answer, incorrect answer, or no answer.
- Simulator steady state questions with each objective as: correct answer or incorrect answer. Simulator dynamic question as: points awarded for each parameter within permit limits for the duration of the simulation for each parameter.

Scoring

The overall score for the Process Control event is the sum of the points earned in the electronic multiple choice and the process simulator.

The electronic multiple-choice score will be presented based on the number of correct answers and the point value for each question after the questions are completed and answers submitted. In general, multiple choice questions range from 10 to 30 points each.

For the electronic multiple-choice questions, there are three possible results: no answer, incorrect answer, or correct answer. For no answer or incorrect answer, zero points are awarded. If the question is answered correctly the score is the point value of that question.

The process simulator software will add all the points earned for objectives achieved in all the problems. This will be the score for the simulator event. There are no penalties in this event.

There are no penalties for incorrect answers or not answering a question.

Half Credit and Showing Work

There is no partial credit available on the Virtual Process Control Event

Scope

The questions will cover the following areas of wastewater treatment as well as general topics such as: collections, pumping, maintenance, laboratory, safety, flow measurement, and metering:

Process Areas	Example Systems
Collections System	Odor Control Inspection and Testing Pipeline Cleaning and Maintenance Underground Repair and Construction
Preliminary Treatment	Screening Grit Removal Flow Equalization
Odor Control	Wet Chemical Scrubbing Chemical Addition Biofilters
Primary Treatment	Primary Sedimentation Flow Equalization Clarification
Secondary Treatment Suspended Media	Activated Sludge Biological Nutrient Removal Clarification Sequencing Batch Reactors
Secondary Treatment Fixed Media	Trickling Filtration Rotating Biological Contactors Biological Nutrient Removal
Advanced Treatment	Filtration Biological Nutrient Removal
Thickening	Gravity Belt Thickener Dissolved Air Flotation Gravity Thickening Rotary Drum Thickening
Solids Stabilization Methods	Anaerobic Digestion Aerobic Digestion
Dewatering	Belt Filter Press Drying Beds Centrifuge Dewatering
Disinfection	Chlorination \ Dechlorination Ultraviolet Disinfection
Management and Support	Process Instrumentation Treatment Plant Security

Resources

The following references will be used in creating and grading the test questions:

- Water Environment Federation: Wastewater Treatment Fundamentals I – Liquid Treatment
- Water Environment Federation: Manual of Practice 11 and Study Guide
- Water Environment Federation: Wastewater Collection System Operator Certification Studybook
- The monthly *Water Environment & Technology Operations Forum* WEF Skills Builder quiz: <http://www.wef.org/SkillsBuilder/>
-

Additional general study material includes:

- EPA design manuals, which can be obtained at: <http://nepis.epa.gov/EPA/html/pubindex.html>. Select *Browse* to see the full list of available documents. Only some are applicable to wastewater.
- Wastewater Engineering Treatment Disposal, and Reuse, Metcalf and Eddy, McGraw-Hill
- Note that these sources will NOT be used in creating or grading tests. They are listed for those interested in additional sources of wastewater knowledge.

Test Details

The same test is used for both Division 1 and Division 2.

The electronic multiple-choice test will consist of up to 75 questions with four possible answers each.

The Simulator portion of the event will consist of 10 steady state questions and 1 dynamic question that will run for a longer duration.

Formula sheets, reference books or any other material are not permitted. Teams will be monitored via video to confirm the rules are followed.

Team members may talk among themselves but may not be disruptive. Teamwork in solving problems is encouraged. Each team will perform the event with an event judge monitoring team activities via video to confirm that only team members are participating and that no reference materials are used by the team.

Notes

The exact number of questions may change slightly between now and the event. The points may also be adjusted to ensure test balance.

Process Control Event committee members will be available to discuss scoring of test questions the morning after the event.