Freese and Nichols Process Control Event

The process control event for the 2013 Texas Competition will be similar to the 2012 WEFTEC event. Remember that new to 2012; the questions will have a wider range of point values, and time will not be mathematically factored into the event score.

Overview

The event consists of answering a number of multiple choice questions, some short math questions with multiple choice answers, and up to five operational type scenarios that have four to six questions each that may require considerable calculations. The event is timed, with a total of 25 minutes. The team can split up the test any way it chooses during the test. The team that scores the most points for correct answers will win. The event should be viewed as an opportunity for a team to demonstrate their accumulated knowledge of wastewater treatment and skill in plant process control.

Time will continue to be an important factor in the test. The total time available for each team for all portions of the test event is 25 minutes. Details of the test procedures will be announced prior to the start of the event.

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, 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 do not run out of questions to answer.
The types and difficulty level for questions are roughly matched to the points awarded for getting the correct answer. Solving the process scenario questions are 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.

Process Scenario Categories

The scenario problems will include the following processes:

- Anaerobic digestion
- Rotary drum thickening
- Activated sludge
- Aeration
- Disinfection

Grading

The tests will be graded as follows:

- multiple choice questions as: correct answer, incorrect answer, or no answer
- short math multiple choice questions as: correct, incorrect, or no answer as well as whether work is shown on test paper
- operational scenarios as: correct, incorrect, or no answer as well as whether work is shown on test paper.

Scoring

Scoring in the Process Control event consists of adding all of the team's points for correct answers and any partial credit given in math problems. There is no time bonus or penalty for finishing before the time limit.

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

For the multiple choice and extended multiple choice questions, there are three possible results: no answer, incorrect answer, or correct answer. For no answer or incorrect answer, there are zero points. If the question is answered correctly the score is the point value of that question. In general multiple choice questions range from 10 to 30 points each. Extended multiple choice questions range from 25 to 50 points each. The point values are shown on the test pages.

Math questions are handled in the same manner with one additional requirement and one exception. The requirement is that at least some work must be shown to receive any credit. If a correct answer is circled on a math question, but no work is shown, the score will be zero. The exception is that even if there is no answer or the answer is incorrect, the team may receive partial credit for that question if work is shown as described below. In general short math questions range from 25 to 50 points each. Operational scenario questions may range from 25 to 200 points.

Grading of Questions (percent of question value awarded)				
Test section	**Correct answer[1]**	**No answer**	**Incorrect answer**	**Correct answer AND showing work**
Multiple choice	100%	0	0	N/A
Extended multiple choice	100%	0	0	N/A
Short math multiple choice	0[1]	50%*	50%*	100%*
Operational scenarios	0[1]	50%*	50%*	100%*

[1]**For any math questions, there are no points for a correct answer if no work is shown**.

*Partial credit for showing work as described below

If a Judge determines that a team member is not attempting to help with parts of the test, a 500

point penalty will be assessed for each non-participating team member.

Partial Credit and Showing Work

For any math question, the team must write out the numbers used and show them in an equation form.

Example:

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16 mg/l x 8.34 x 2.4 MGD = 320 lbs
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Simply putting down numbers does not count. The equation used must also be relevant to the question. e.g. there will not be credit for writing down the lbs formula when the question is about detention time. The work shown must be consistent with the operational theory described in the problem.

For the math and operational scenario questions, if the grader feels that the work shown demonstrates correct and significant, but incomplete, progress towards the answer the work shown may receive the partial credit listed in the Points table. If the work shown uses a conceptually incorrect approach partial credit might not be awarded.

Note that in the Operational Scenarios, sometimes answers that are text rather than numbers may still require work to be shown. 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.

The Test Grader can only use what the Test Taker writes down to determine how the test taker is attempting to solve the problem. Therefore it is the responsibility of the test taker to clearly show how he or she arrived at an answer. The Grader cannot infer missing steps in solving the problem. If additional work is shown on the back of pages or separate sheets, there should be a reference as to which question the work applies or credit may not be given.

Scope

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

Process Areas	**Example Systems**
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

Process Areas	Example Systems
	Clarification Sequencing Batch Reactors
Secondary Treatment Fixed Media	Trickling Filtration Biological Nutrient Removal
Advanced Treatment	Filtration Biological Nutrient Removal
Thickening	Dissolved Air Flotation Gravity Belt Thickener Gravity Thickening Rotary drum Thickener
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 Manual of Practice 11
- The monthly *Water Environment & Technology Operations Forum* WEF Skills Builder quiz: http://www.wef.org/ SkillsBuilder/
- The WEF/ABC study guide
- California State University Sacramento Operations of WWTPs volumes 1 & 2 and Advanced Waste Treatment
- Collections Systems questions will be based on the Sacramento Manual, Operations and Maintenance of Wastewater Collections Systems.
- Manual on the Causes and Control of Activated Sludge Bulking and Foaming, Jenkins, Richards & Daigger

Questions on Operations Central Certification Quiz on the WEF website are recommended as resource study materials.

Additional general study material includes:

- EPA design manuals, which can be obtained at http://water.epa.gov/learn/training/index.cfm. 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 multiple choice test will consist of 42 questions with four possible answers each, fifteen multiple choice questions requiring a small amount of math, and 20 questions where each answer is chosen from a list of 20 possible answers (extended multiple choice).

Four or five process scenarios with four to six questions each are in the test. Teams may answer as many parts of any scenario that they desire.

Formula sheets, reference books or any other material are not permitted.

Team members may talk among themselves but may not be disruptive. Teamwork in solving problems is encouraged. Also consider that other teams may overhear your discussions.

General Details

What will be supplied at the event: Answer sheet forms and scratch paper for calculations. Competitors must supply their own No. 2 lead pencils and calculators (calculators cannot have programming or printout capability)

All four team members must be present before the start of the event.

If a team is disqualified from the event they will receive a score based on every question left blank and no work shown.

The Judges will not have reference books available at the event; plan on bringing your own copies as needed. (No reference material can be used during the test)

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