

Environmental Chemistry
Hybrid Event
Chemistry Committee Trial Event

1. **DESCRIPTION:** This event will focus on fresh water (e.g., residential, industrial or natural), The Clean Water Act (1972 & 1977 – certain pages specified at the end), wastewater operator’s certification manual (Indiana March 2018 revision) and its applications, and various testing of particular analytes using standardized curves (either interpreted or created).

A TEAM OF UP TO: 2

EYE PROTECTION: C

EVENT TIME: 50 minutes

2. **EVENT PARAMETERS:**

- a. Teams should bring pencils for graphing and answering questions, a ruler (12-15 in.) for best fit line approximation, two stand-alone non-programmable, non-graphing calculator, and one three-ring binder of any size containing information in any form and from any source attached using the available rings. Sheet protectors are permitted. Participants may not remove information or pages for during the event.
- b. Event Supervisors will provide samples to be tested and whatever other reagents, glassware, information (e.g., periodic table, charts, instrumentation) are appropriate for the task(s) participants are asked to perform.
- c. Participants must wear the following or they will not be allowed to participate: closed-toed shoes, ANSI Z87 indirect vent chemical splash goggles (see <http://soinc.org>), pants or skirts that cover the legs to the ankles, and additionally a long-sleeved lab coat that reaches the wrists and the knees or a long-sleeved shirt that reaches the wrists with a chemical apron that reaches the knees. Chemical gloves are optional. Students who unsafely remove their safety clothing/goggles or are observed handling any of the material or equipment in a hazardous/unsafe manner (e.g., tasting or touching chemicals or flushing solids down a drain and not rinsing them into a designated waste container provided by the supervisor) will be penalized and/or disqualified from the event.

3. **THE COMPETITION:**

- a. The competition will consist of a series of tasks similar to that of first year high school chemistry. Tasks could include hands-on activities, questions about a topic, interpretation of experimental data (e.g., graphs, diagrams), generating a standardized curve using data provided, using a given standardized curve to determine unknowns, or observation of an experiment set up & running. Supervisors are encouraged to use computers or calculators with sensors/probes. Participants may be asked to collect data using probe-ware that has been set up & demonstrated by the Supervisor. The Supervisor may provide Participants with data sets collected by such sensors/probes following demonstration of the data collection. Data will be presented in tabular and/or graphic format & students will be expected to interpret the data. Participants should be aware that nomenclature, formula writing & stoichiometry are essential tools of chemistry & may always be part of an event. Stoichiometry could include mole conversions, conversions to parts per million (ppm) whose units are mg/L or parts per billion (ppb) whose units are $\mu\text{g/L}$.
- b. Participants will generate one standardized curve by serial dilution at the Regional level, two to three curves at the State level, and 3 or more at the National level. Standardized curves will be generated either from, data given about standards already read, reading standards provided, or making and reading standards (State & National level only).
- c. No hazardous analyte will be used in this event. Analytes suggested as hazardous will be measured by something safe and non-harmful (typically colorimetric or by probe such as a millivolt reading).
- d. Analytes which are to be determined may come from the following list. Analytes of interest with respect to all water types are as follows:

| | |
|--------------------------------------|------------------------------|
| i. Ammonia | vii. Conductivity |
| ii. Phosphorous | viii. pH |
| iii. COD – High Range | ix. Salinity |
| iv. COD – Low Range | x. Total Dissolved Solids |
| v. Residual Chlorine (colorimetric) | xi. GC-MS of regulated PCB’s |
| vi. Low Level Chlorine (Amperometry) | |
- e. There will be various scenarios given. Some map reading skills may be required as diagrams and/or maps may be used clearly identified sample sites. Results of unknowns will be used to answer a variety of questions.

4. SAMPLE QUESTIONS/TASKS:

- a. Teams may answer questions concerning the standardized curves in general.
Standard Curve: Participants may be given a standard of known concentration and asked to make a series of dilutions. The dilutions will then be read and recorded. Values will be entered and teams with the better **R² value (i.e. - value closest to R² = 1.000)** may be awarded additional points or used as a tie breaker at the discretion of the event supervisor.
- b. Teams may answer questions about how to choose the appropriate wavelength for a particular analyte.
- c. Teams may answer questions about the relationship between absorbance and transmission.
- d. When given data, teams may have to recreate the standardized curve and use it to determine unknown values. These values will then be used to answer questions about permit limits, violations, etc. Any question where a comparison must be made, with respect to limits, will have those limits provided by the event supervisor.
- e. Teams will be required to generate by hand a standardized curve (graph paper required – 10 sq/in.).
- f. All teams must include on their graph the best fit line and its equation.
- g. Teams may be asked questions about best the fit lines.
- h. Teams may be asked questions about the Clean Water Act (*CWA 1972 or 1977*) – (*pages 1-59 of “Introduction to the Clean Water Act” or CWA 1972, pages 150-234 of “The Clean Water Act” 1977, & ALL pages (86 total) of the Wastewater Operator Certification Manual*).

5. SCORING:

- a. The team with the highest score wins.
- b. Time will not be used for scoring but could be part of the event.
- c. Ties may be broken by the accuracy of the standardized curves, or selected questions chosen by the event supervisor. In other words, the closer the R² value is to 1.000 for standardized curves, the greater the points awarded.
- d. A penalty of up to 10% will be applied if the team’s area is not cleaned up as instructed by the event supervisor.

Recommended Resources: The Science Olympiad Store (store.soinc.org) carries the Chem/Physical Science CDs; other resources are on the trial event page at soinc.org.

Additional Resources Wastewater Operator Certification Manual Updated March 2018 found at:

https://www.in.gov/idem/cleanwater/files/wastewater_cert_booklist_10_manual.pdf

Clean Water Act 1972 – An Introduction

<https://cfpub.epa.gov/watertrain/pdf/modules/introtocwa.pdf>

Clean Water Act 1977 – Revised CWA

<https://www.epa.gov/sites/production/files/2017-08/documents/federal-water-pollution-control-act-508full.pdf>