Environmental

Chemistry

1. **DESCRIPTION:** This event will focus on fresh water, either residential or industrial or natural, The Clean Water Act (1972 & 1977 – certain pages specified at the end), wastewater operator's manual (Indiana 2008 revision) & its applications, and various testing of particular analytes using standardized curves (either interpreted or created).

A TEAM OFUP TO: 2 **EYE PROTECTION: #4** **APPROX. TIME:** 50 min.

2. **EVENT PARAMETERS:**

a. **Students:** must bring pencils for graphing and answering questions, a ruler (12-15in.) for best fit line approximation, a non-programmable, non-graphing calculator, and a 3-ring binder of reference materials.

b. **Supervisors:** must provide samples to be tested and whatever other reagents/glassware are appropriate for the tasks students are asked to do (periodic table, charts, instrumentation, etc.)

c. **Safety Requirements**: Students must wear the following or they will not be allowed to participate: closed-toed shoes, ANSIZ87 indirect vent chemical splash goggles (seehttp://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. **THECOMPETITION:**

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 (graphs, diagrams, etc.), creation of 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. Students may be asked to collect data using probe-ware that has been set up & demonstrated by the Supervisor. The supervisor may provide students 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. Students 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 μg/L.

b. There must be one standardized curve generated at the regional level by serial dilution, two or 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!). NO ANALYTE WILL BE HAZARDOUS! Analytes suggested as hazardous will be measured by something safe and non harmful (typically colorimetric or by probe such as a millivolt reading).

c. There will be various scenarios given. Results of unknowns will be used to answer a variety of questions. Diagrams or maps may be used with the sample sites clearly identified. Naturally there may be some map reading skills involved:

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:

1. Ammonia 2. Phosphorous 3. COD – High Range 4. COD – Low Range 5. Residual

Chlorine (colorimetric) 6. Low Level Chlorine (Amperometry) 7. Conductivity 8. pH
9. Salinity 10. Total Dissolved Solids 11. GC-MS of regulated PCB's.

4. **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 R^2 value is to 1.000 for standardized curves, the greater the points awarded.
d. Penalties: A penalty of up to10% if the team's area is not cleaned up as instructed by the event supervisor.

5. **Sample Activities, Lab Stations, and Relevant Questions:**

a. Teams may answer questions concerning the standardized curves in general.
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.
i. Teams may be asked questions about the Clean Water Act (**CWA 1972 or 1977**) – (**1st 45 pages of "Introduction to the Clean Water Act" or CWA 1972, & 1st 75 pages of "The Clean Water Act" 1977**).

Standard Curve Graph: All standardized graphs must have clearly labeled the best fit line, the points used to calculate slope [$\mathbf{m = \Delta y/\Delta x = (y_2-y_1)/(x_2-x_1)}$], and the equation of the line **(y = mx + b)** used to calculate values for the unknown samples.

Recommended Resources: All reference and training resources including the **Chem/Phy Sci CD** are available on the Official Science Olympiad Store or Website at http://www.soinc.org.

Wastewater Operator Certification Manual Updated July 2008, & which can be found at:

www.epa.gov/greatlakes/p2/pollsolu/wastewater_certification_manual.pdf

Clean Water Act 1972 – An Introduction

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

Clean Water Act 1977 – Revised CWA

www.epw.senate.gov/water.pdf