ENVIRONMENTAL CHEMISTRY

See General Rules, Eye Protection & other Policies on www.soinc.org as they apply to every 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 calculators, 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 during the event.
   b. Event Supervisors will provide samples to be tested and **any** 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 goggles, an apron or a lab coat and have skin covered from the neck down to the wrist and toes. Gloves are optional, but if the host requires a specific type they will notify teams. Pants should be loose fitting; if the host has more specific guidelines they will notify teams in advance of the tournament. Shoulder length or longer hair must be tied back. Participants removing safety clothing/ goggles or unsafely handling materials or equipment will be penalized or disqualified.
   d. Teams should bring any or all of the items listed as Recommended Lab Equipment for Division C Chemistry Events, posted on soinc.org. Teams not bringing these items will be at a disadvantage, as they are not provided.

3. **THE COMPETITION:**
   a. **The competition will consist of a series of tasks that 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**, concentration conversions** are essential tools of chemistry & may always be part of an event.
   b. Participants will generate one standardized curve by serial dilution at the Regional level, two to three curves at the State level, and three 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 analytes will be used in this event. Analytes identified as hazardous will be measured in a safe and non-invasive manner (typically colorimetric or by probe such as a millivolt reading). 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
      ii. Phosphorous
      iii. COD – High Range
      iv. COD – Low Range
      v. Residual Chlorine (colorimetric)
      vi. Low Level Chlorine (Amperometry)
      vii. Conductivity
      viii. pH
      ix. Salinity
      x. Total Dissolved Solids
      xi. GC-MS of regulated PCBs

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 R^2 value (i.e. - value closest to $R^2 = 1.000$) 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 the best 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 score will be comprised of approximately 60% of the points for wet chemistry tasks/making & interpreting standardized curves, 20% of the points for equations and interpreting data, and approximately 20% of the points for questions on the Clean Water Act and the Indiana Wastewater Operators Manual.
   b. The team with the highest score wins.
   c. Time will not be used for scoring but could be part of the event.
   d. 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.
   e. 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 a variety of resources to purchase for this event; other resources are on the Event Pages at soinc.org