

## SCOUT & NAVIGATOR CLASS - PREVIEW MISSION

### Maintaining Healthy Waterways II: Delaware River and Bay

- Retrieve a sediment sample from inside a drain pipe to analyze for contaminants
  - Collecting the sediment sample from inside the pipe
  - Returning the sediment sample to the surface
  - Determine the type of contaminant(s) present in the sediment sample

#### **Product Demonstration Notes:**

Companies will be required to retrieve a sediment sample from inside a short section of drain pipe and test the sediment for contaminants. The drain pipe will be simulated by a 5-gallon bucket. The bucket will rest on its side and will be weighted so it does not roll.

The sediment sample will be constructed from 1 ½-inch PVC pipe with end caps on both ends. A length of rope will act as a grab point on the 1 ½-inch pipe. The sample will be no more than 10 cm inside the bucket. Companies will receive points when they successfully remove the sediment sample from the drain pipe. Successfully removing the sediment sample is defined as the sample under control of the ROV, not touching the bottom, and completely outside of the bucket. Note that the ROV must pick up the sediment sample from inside the bucket. The bucket cannot be lifted, shaken, or otherwise moved to cause the sediment sample to fall or roll out of the open end of the bucket.

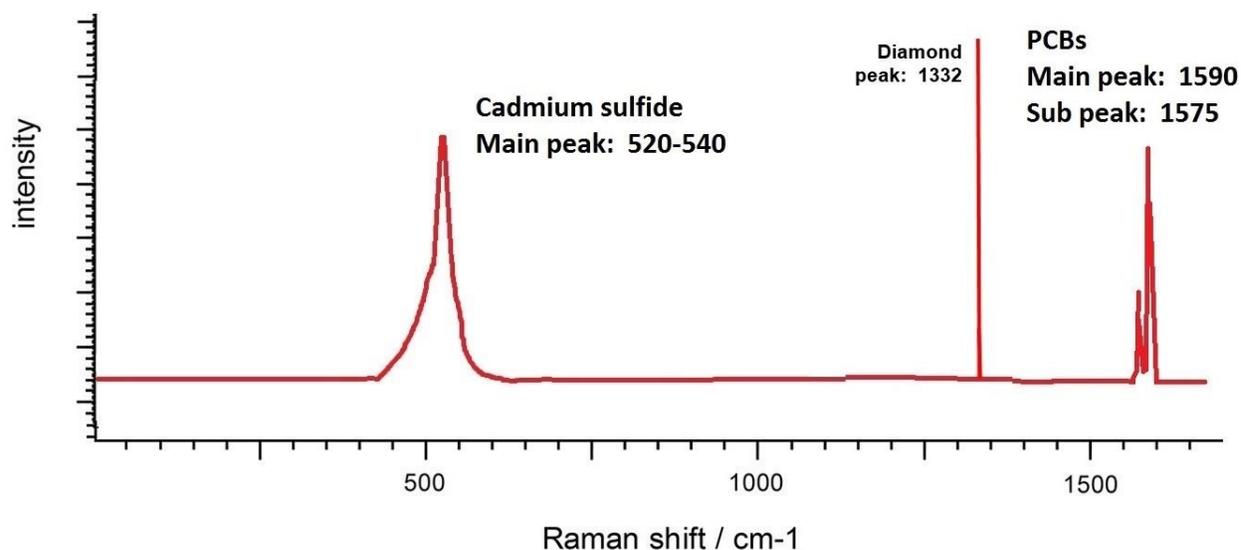
Once the sediment sample has been removed from the drain pipe, it must be returned to the surface. Companies will receive points when they successfully remove the sediment sample from the pool. Successfully removing the sediment sample is defined as returning the sample to the surface, side of the pool and placing it on the pool deck.

Once the sediment sample is at the surface, companies can retrieve the sediment's Raman spectrum.\* In this case, the spectrum will be printed on a laminated sheet and rolled up inside the 1 ½-inch pipe of the sediment sample. Companies must compare the sample's spectrum to a chart of peaks and sub peaks of known chemical contaminants. A copy of the chart will be available at the product demonstration station. Companies must evaluate the spectrum and the chart to determine what type of contaminant is present in the sediment. Companies will receive points when they successfully determine the contaminant present in the sediment. Successfully determining the contaminant is defined as showing the station judge which chemical contaminant from the chart matches the peaks and sub peaks of the spectrum retrieved in the sediment sample. The spectrum will contain peaks and sub peaks for only one chemical contaminant.

\*Note: Raman spectroscopy is commonly used in chemistry to determine the chemical composition of an object or substance. It can identify and quantify molecules and produce a chemical "fingerprint" of that object or substance. For more information about Raman spectroscopy, see the REFERENCE section of the competition manual.

In Raman spectroscopy, diamonds are used as reference peaks in spectra from unknown sources. The spectrum will have a diamond spike for reference purposes.

Chemical contaminant	Main Peak (cm <sup>-1</sup> )	Sub Peak(s) (cm <sup>-1</sup> )
Arsenic Sulfide	385	420
Cadmium Sulfide	520 – 540	
Copper Oxide	297	
Diamond	1332	
Lead	1054	
Mercury	547	435
Polyflouroalkyl	1560 to 1580	1325
PCBs	1590	1575



*Raman spectrum of sediment contaminated with CdS (520-540 cm<sup>-1</sup>) and PCBs (1590 and 1575). Note the diamond peak (1332 cm<sup>-1</sup>).*

## PROP BUILDING INSTRUCTIONS & PHOTOS

### Drain Pipe

The drain pipe will be constructed from a 5-gallon bucket laying on its side. The bucket will be weighted with bricks so it does not roll.

### Sediment sample:

The sediment sample will be constructed from a 10 cm length of 1 ½-inch PVC pipe with two 1 ½-inch end caps attached to each end. ¼-inch holes will be drilled in the end caps and the pipe to allow water into the pipe. A 40-cm length of rope will act as a grab point for the sediment sample.



Sediment sample: 1 ½-inch pipe with end caps.



Sediment sample inside drain pipe.