

RANGER & EXPLORER CLASS - PREVIEW MISSION

Maintaining Healthy Waterways II: Delaware River and Bay

- Retrieve a sediment sample from inside a drain pipe to analyze for contaminants
 - Deploying a device into the pipe to collect the sediment sample
 - 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 the end of a drain pipe and test the sediment for contaminants. The drain pipe will be no longer than 3.2 meters and constructed from [6-inch Corex drain pipe](#). The Corex drain pipe will rest on the bottom of the pool and will not curve. The far end of the pipe will be covered. The drain pipe will be weighted down.

The sediment sample will be constructed from 1-inch PVC pipe with two 1-inch end caps attached to each end. Holes will be drilled in the pipe and the end caps to allow water into the pipe. A 32-cm length of rope will act as a grab point for the sediment sample. The 1-inch pipe will be covered with [white industrial strength Velcro loops](#). The sediment sample will be located at the far end of the drain pipe.

Companies may build and deploy a secondary (micro-ROV) from their primary ROV or develop and build another device to retrieve the sample from the end of the drain pipe. Companies will receive points when the sediment sample is successfully removed from the 6-inch pipe. Successfully removing the sediment sample from the pipe is defined as the 1-inch pipe of the sediment sample completely outside of the 6-inch Corex drain pipe. The micro-ROV or other device must move into the drain pipe and remove the sample. The Corex drain pipe cannot be lifted, shaken, or otherwise moved or manipulated to cause the sediment sample to fall or roll out of the open end.

Companies should be prepared for low light levels inside the Corex drain pipe.

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.

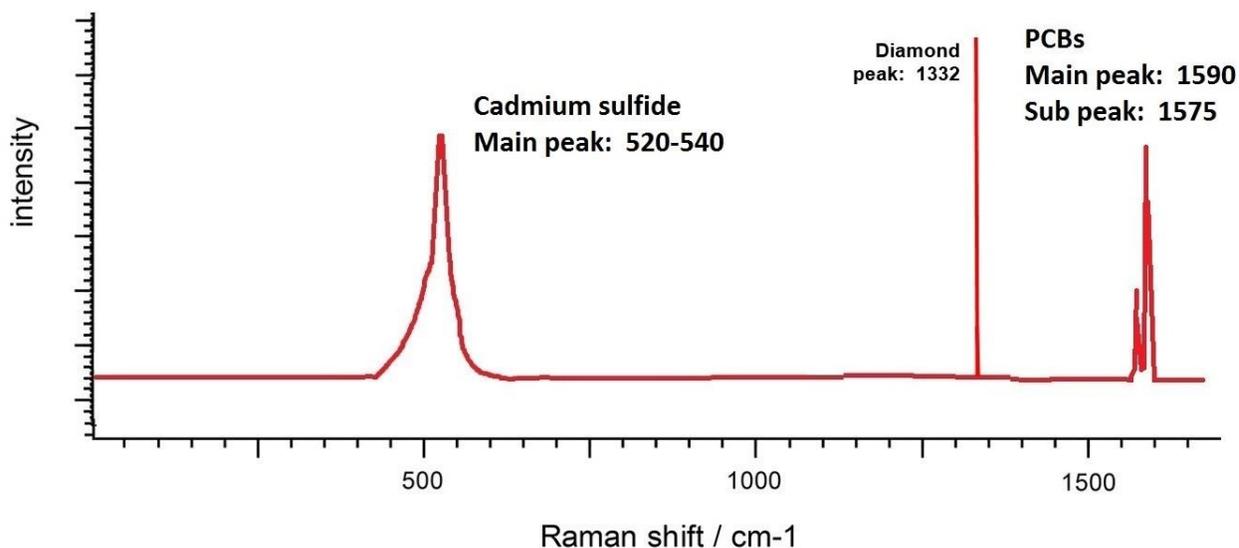
Once the sediment sample is at the surface, companies can retrieve the sediment's Raman spectrum.* In this case, the spectrum will be printed on a laminated sheet and rolled up inside the 1-inch pipe of the sediment sample. Companies must compare the sample's spectrum to a chart of peaks and sub peaks 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(s) are present in the sediment. Companies will receive points when they successfully determine the contaminant(s) present in the sediment. Successfully determining the contaminant(s) is defined as showing the station judge which chemical contaminant(s) from the chart match the peaks

and sub peaks of the spectrum retrieved in the sediment sample. The spectrum will contain peaks and sub peaks for one or two chemical contaminants.

*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. The chemical fingerprint, also known as the spectrum, is generated when the scattered Raman photons pass into a detector where they are broken into their respective wavelengths and plotted. 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.

<u>Chemical contaminant</u>	<u>Main Peak (cm⁻¹)</u>	<u>Sub Peak(s) (cm⁻¹)</u>
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

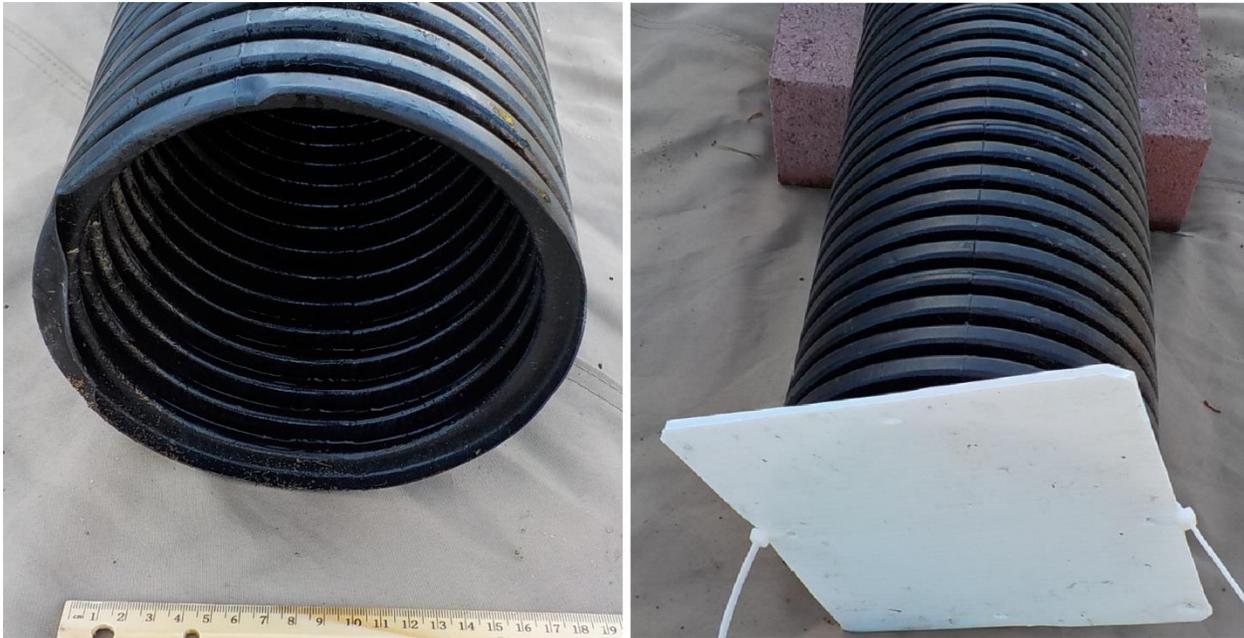


Raman spectrum of sediment contaminated with CdS (520-540 cm⁻¹) and PCBs (1590 and 1575). Note the diamond peak (1332 cm⁻¹).

PROP BUILDING INSTRUCTIONS & PHOTOS

Drain Pipe

The drain pipe will be no longer than 3.2 meters and constructed from [6-inch Corex drain pipe](#). The Corex drain pipe will rest on the bottom of the pool and will not curve. The far end of the pipe will be covered. The drain pipe will be weighed down.



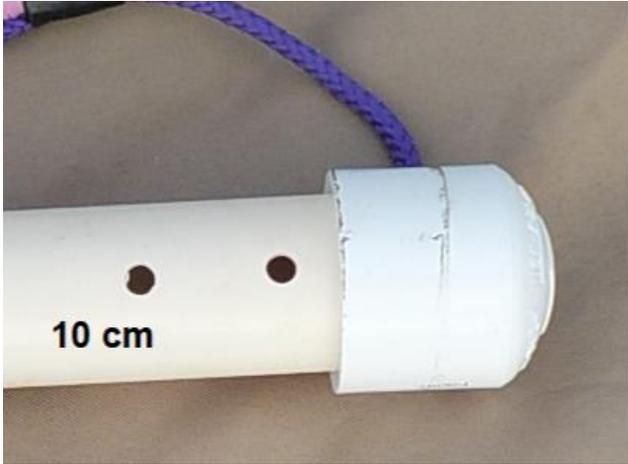
Left: Open end of the 6-inch Corex drain pipe. Right: Covered end of the 6-inch Corex drain pipe.



Drain pipe.

Sediment sample:

The sediment sample will be constructed from a 10 cm length of 1-inch PVC pipe with two 1-inch end caps attached to each end. $\frac{1}{4}$ -inch holes will be drilled in the end caps to allow water into the pipe. A 32-cm length of rope will act as a grab point for the sediment sample. The 1-inch pipe will be covered with [white industrial strength Velcro loops](#).



Left: Sediment sample without Velcro. Right: Sediment sample with Velcro.



Sediment sample located at far end of drain pipe. Note: This photo is taken through the far end of the pipe (the covering on the far end has been removed).