

## Notes for Power Point for Lesson 1: Cadmium in the Cove

Slide	Notes	Additional Notes
1	The Hudson River is just beyond the right edge of the photo. A small bit of Foundry Cove is visible at the bottom right. South Cove is visible in the distance.	
2	In the 1970's, scientists discovered that Foundry Cove, near Cold Spring, NY was contaminated by extremely high levels of very toxic metals: cadmium, nickel, and chromium. The Marathon Battery Factory was discharging its industrial wastes into the cove and had been doing so for over two decades. Of the three metals, cadmium is the most toxic of the three and was released in the greatest quantity, and scientific research has focused on it.	
3	Ask students to find the Hudson River and their town on the map on the left. Foundry Cove is a small cove located about 50 miles north of Manhattan on Hudson River Estuary and across the river from West Point Military Academy. Marathon Battery Factory made nickel-cadmium batteries for first for the military and then for general commercial uses.	
4	All three of these metals are toxic to humans and other animals.	
5		
6	Scientists collected sediment samples and then sieved samples from Foundry Cove and near the Constitution Marsh Audubon Sanctuary, just two miles to the south. Ask: Why would scientists collect samples from both Foundry Cove and Constitution Marsh? What might they be trying to learn? Over several decades, scientists collected data on cadmium levels in sediments, organisms, and water.	
7	The <b>outfall</b> is where metal-polluted wastewater was dumped into Foundry Cove. Point out the <b>railroad trestle</b> , which is the only place that Hudson River water moves in and out on the tides. Prior to the construction of the railroad, the whole cove was open and water flowed freely between the cove and the river. Orient students to other parts of the map: water in Foundry Cove and in the Hudson, marshy area (dark), land, isoline (dotted lines), and sample sites (black dots). The <b>isolines</b> mark boundaries between different levels of contamination, similar to lines marking elevations on a topographic map. For example, the space between 1000 and 3000 show the area of the cove where sediment levels of cadmium are between 1000 ppm and 3000 ppm. Volunteers can come to the screen, point to a sample site, and estimate the ppm for that location, based on information in	

	<p>the map. Have students explain how they arrived at their estimation. Ask students: where is the cadmium level highest? Lowest? Why do you think that might be? (Hint: tides) Over time, sediments in the cove slowly migrate from the back of the cove to its mouth at the train trestle, pulled by the tides.</p>	
8	<p>Ask students what differences they notice in the two maps. Point out approximately where the marsh would be in the 1983 map. (If you have a Smart Board or similar technology, you or a student can sketch in approximately where the marsh line would be in the second map. Ask: how do you think this might have happened? What do you think caused the changes in contamination levels? Where might the cadmium have gone?</p> <p>The Marathon Battery Factory ceased operations in 1979. Cadmium is an element that is denser than water. That means it doesn't break down and it tends to sink. No clean up activities were conducted between 1975 and 1983. Natural factors were responsible for changes in cadmium levels. The two biggest factors are tidal movement and sediment deposition. Sediment is delivered by the tides and by Foundry Cove Creek and other sources of freshwater runoff and snowmelt</p>	
9	<p>As you saw in the two maps we just looked at, there is less cadmium in Foundry Cove. Ask: Where do you think the cadmium went? Possible answers: carried out by tides, covered by sediments, carried to different parts of the cove by water movements, eaten by animals</p>	
10	<p>Scientists collected water from both the Hudson River and Foundry Cove and analyzed suspended particles to learn about how cadmium moved into and out of the cove. Cadmium was found in very low levels in the water. Most of it remained in the sediments. Overall, there was a small net flow of cadmium out of the cove, meaning that more cadmium left the cove on outgoing tides than was carried back into the cove on incoming tides.</p>	
11	<p>Toxin pathways need to be studied in order to understand risks to environmental health and human health. Environmental field research informs ecologists, toxicologists, and resource managers about where, when, and how toxins move from place to place. Once organisms become contaminated, the toxin can accumulate in living tissues and move up the food chain. Biomagnification of toxins results in higher levels in those animals at the top of the food chain. A famous case is that of DDT, when high levels in bald eagles, pelicans, osprey, and other top predators nearly caused their extinction.</p>	