Phosphorus

Phosphorus is a plant nutrient – it helps plants grow. Commercial fertilizers contain phosphorus, which is mined in huge quantities from deposits around the world. In natural waters phosphate (PO_4) is the most abundant and stable form of phosphorus, but organic particles containing phosphorus can also be important. Natural sources of phosphate include erosion (weathering) from phosphate-rich rocks, and recycling of phosphorus from organic matter. In the Hudson, as in many rivers, particulate detritus and sewage delivered from tributaries are the main sources of phosphorus.

Phosphate is often considered the "limiting factor" in freshwater ecosystems, which means that it controls how much plant growth can occur. But, since the Hudson River has high levels of turbidity, very little light is able to penetrate the river. Without light, an increase in phosphates has little impact on plant growth. If turbidity were to decrease in the Hudson, which is loaded with nutrients, it would experience huge algal blooms. If a stream that runs into the Hudson receives too much phosphate, the growth of algae explodes, as long as other essential plant nutrients, including nitrate, are present. This is called an algal bloom. Standing water becomes murky choked with aquatic plants. In fast moving streams, most of the growth occurs as green slime on rocks and other hard substrates, rather than on the surface of the water. When the plants die and settle to the bottom, the bacteria that decompose the plants use up the available oxygen. The oxygen levels get so low that many types of fish and insects can no longer survive in the water. This process is called eutrophication (see the reading on 'Eutrophication' for more information).

Man-made phosphates come from sewage, agricultural runoff, and detergents, although most manufacturers have removed the phosphate in detergents. In fact, New York State has banned phosphates in detergents altogether. The main sources of phosphates to our water systems are human sewage (the human body releases about 3 pounds of phosphate each year), and agricultural waste from livestock. The Hudson has phosphate concentrations that average about 0.06 mg PO_4 / L, and if all forms of phosphorous are added together (called total phosphorus or TP), the concentration is about 0.1 mg TP /L. Levels in New York harbor are generally higher due to the presence of more sewage.

What does this mean?

Clean water has low phosphates, usually between 0.01 and 0.03 mg/l of PO_4. Readings higher than 0.3 mg/l indicate pollution from fertilizer, sewage, industrial waste or detergents. Phosphate is usually read as orthophosphate in test kits. Waste water is 5 to 30 mg/l phosphate. Drinking water must be less than 0.5 mg/l phosphate, according to federal law. The Hudson generally has levels of PO_4 that indicate moderate levels of pollution; recent samples from the mid-Hudson region indicate that most tributaries had levels of orthophosphate above 0.3 ppm as PO_4, especially downstream of sewage treatment plants.