Questions for Mercury and Minamata Reading

1. What are the symptoms of this disease?

2. What was the source of this disease?

3. Inorganic mercury was thought not to be able to get into the food chain but it was able to. Explain how.

4. Why is methyl mercury much more dangerous?

5. Identify and describe the 4 factors for evaluating and treating environmental pollutants?

A CLOSER LOOK 14.2

MERCURY AND MINAMATA, JAPAN

In the Japanese coastal town of Minamata, on the island of Kyushu, a strange illness began to occur in the middle of the twentieth century. It was first recognized in birds that lost their coordination and fell to the ground or flew into buildings and in cats that went mad, running in circles and foaming at the mouth.[10] The affliction, known by local fishermen as the "disease of the dancing cats," subsequently affected people, particularly families of fishermen. The first symptoms were subtle, fatigue, irritability, headaches, numbness in arms and legs, and difficulty in swallowing. More severe symptoms involved the sensory organs; vision was blurred and the visual field was restricted. Afflicted people became hard of hearing and lost muscular coordination. Some complained of a metallic taste in their mouths; their gums became inflamed, and they suffered from diarrhea. Eventually, 43 people died and 111 were severely disabled; in addition, 19 babies were born with congenital defects. Those affected lived in a small area, and much of the protein in their diet came from fish from the Minamata Bay.

A plastic factory on the bay used mercury in an inorganic form in its production processes. The mercury was released in water effluent that flowed into the bay. Mercury forms few organic compounds, and it was believed that the mercury, although poisonous, would not get into food chains. But microbial action converted inorganic mercury into methyl mercury, an organic compound that turned out to be a much more harmful form. Inorganic mercury does not pass through cell membranes readily. However, methyl mercury readily passes through cell membranes and is transported by the red blood cells throughout the body; it enters and damages brain cells.[11] Fish absorb methyl mercury from water 100 times faster than they absorb inorganic mercury. This was not known before the epidemic in Japan. Once absorbed, methyl mercury is retained two to five times longer than is inorganic mercury.

Harmful effects of methyl mercury are dependent on a variety of factors, including the amount and route of intake, the duration of exposure, and the species affected. The effects of the mercury are delayed from 3 weeks to 2 months from the time of ingestion. If mercury intake ceases, some symptoms may gradually disappear, but others are difficult to reverse.[11]

The mercury episode at Minamata illustrates four major factors that must be considered in evaluating and treating environmental pollutants. First, *individuals vary in their response to exposure to the same dose, or amount, of a pollutant.* Not everyone in Minamata responded in the same way; there was variation even among those most heavily exposed. Because we cannot predict exactly how any single individual will respond, we need to find a way to state an average expected response of individuals in a population. Second, *pollutants may have a* **threshold,** that is, a level below which the effects are not observable and above which the effects become apparent. Symptoms appeared in individuals with concentrations of 500 ppb of mercury in their bodies; no measurable symptoms appeared in individuals with significantly lower concentrations. Third, *some effects are reversible.* Some people recovered when the mercury-filled seafood was eliminated from their diet. Fourth, *the chemical form of a pollutant, its activity, and potential to cause health problems are changed markedly by ecological and biological processes.* In the case of mercury, its chemical form and concentration changed as the mercury moved through the food webs.