Update on Fukushima Expedition
July 18, 2011

On June 18, the international team led by Ken Buesseler of the Woods Hole Oceanographic Institution completed its 15-day research expedition to take water and biological samples and study ocean currents in the Pacific Ocean off the Fukushima nuclear power plant. The team began sampling 400 miles offshore and worked their way toward the coast within site of the reactors -- about 20 miles from the nuclear complex. Their goal was and is to assess the levels and dispersion of radioactive substances and to determine the extent to which radionuclides are accumulated in marine life at the base of the food chain and juveniles and adults of smaller fish species that serve as prey for many larger marine life, including some commercially important fish.

Radiation exposure for humans
During their time at sea, members of the team monitored radiation levels on board the ship daily and found these were well below any level that would be cause of concern for direct exposure. In fact, because they were at sea, the levels were below what the team would have been exposed to had they been on land, primarily due to natural radiation from soil and rocks.

Radiation levels in the area the team worked were not of concern for direct human exposure. Had the team detected high levels of radioactivity on the ship or in the ocean, it would have notified authorities immediately and left the area in which they were working for a safer location.

Pathways for radiation transport
The team also deployed floats to track ocean circulation off shore of the nuclear complex. Water samples they collected will be analyzed in various labs over coming months, and the data these analyses generate will be used to generate a set of concentration maps for many different radionuclides. By combining circulation data with concentration data we can begin to understand the dispersion patterns and thus the potential near- and long-term fate of the releases and related public health issues.

Radiation exposure for marine life
The team conducted more than 100 net tows to collect biological samples of phytoplankton zooplankton (the base of the food chain) as well as small fish. These are the first place one would expect to see accumulation of radionuclides. From the

biological samples, the scientists involved will work to assemble a picture of the radionuclide concentrations in those biological samples and how much of the accumulation is due to releases from the Fukushima reactors.

While this biological work is the first step in answering the many unknowns about the impact of radioactivity to marine life, there are many questions that need to be answered that are beyond the scope of the team's work. They include: How much seafood is safe to eat? What is the risk presented by different types of seafood? What parts of the ocean are safe to fish and when, if ever, will the most heavily contaminated regions become safe again?

Accomplishments
While at sea, the team's accomplishments include:

* Collecting more than 1,500 samples ranging from 50 milliliters to 20 liters from more than 300 logged sampling events, plus samples of particulates taken from water volumes as large as 1,000 liters
* Amassing more than 3,000 liters of water samples weighing more than 3 metric tons that will be shipped to labs around the world for radionuclide analyses
* Making more than 100 tows resulting in about 50 pounds of biological samples (though there is still quite a bit of water in these samples yet).

Over the coming months 16 labs in seven countries will analyze samples for a more comprehensive set of isotopes than have been analyzed to date that includes cesium-134 and -137; strontium-90; iodine-129; tritium; uranium-236; plutonium-239 and -240; rutherium-103 and -106; cerium-141 and -144; radium-223, -224, -228, and -226; and neptunium-237.

What's next
The analysis will help give a clearer idea of how much radiation is out here, where it's going, how quickly it's mixing into the ocean, and to what extent it is working its way into the marine food chain and removed via physical and biological processes.

The results of these analyses will take time, with the first results likely to be issued in six months and continue for several years. The nuclear accident at Fukushima is an unprecedented event for the ocean. It will take time and continued sampling and analysis to obtain a more comprehensive understanding of radionuclide levels and their fate.