Fact Sheet:
2011 Japan Nuclear Incident

What is Radiation?
Radiation is energy moving in the form of particles or waves. Familiar radiations are heat, light, radio waves, and microwaves. Another form of radiation is called ionizing radiation. It is a very high-energy form of electromagnetic radiation that has the ability to ionize anything it comes into contact with, making it a potential health concern.[1]

Where does radiation come from?
Some of the elements on the periodic table emit radiation due to the instability of their nucleus. Radioactive elements relevant to the current situation in Japan include Iodine-131, Cesium-137, Strontium-90 and Plutonium.[2] Note that many naturally-occurring elements with which we are familiar, such as Potassium in bananas, contribute to the background radiation to which we are commonly exposed.

Tell me more about ionizing radiation.
Ionizing radiation is any radiation capable of displacing electrons from atoms, thereby producing ions. High doses of ionizing radiation may produce severe skin or tissue damage. There are several types of ionizing radiation: alpha particle, beta particle, gamma ray, neutron, x-ray.[1] The three relevant to the incident in Japan are alpha, beta and gamma radiation:

> *Alpha particles* generally carry more energy than gamma or beta particles, and deposit that energy very quickly while passing through tissue. They can be stopped by a thin layer of light material, such as a sheet of paper, and cannot penetrate the outer, dead layer of skin. Therefore, they do not damage living tissue when outside the body. When alpha-emitting atoms are inhaled or swallowed, however, they are especially damaging because they transfer relatively large amounts of ionizing energy to living cells.[1]
>
> Although *beta particles* can be stopped by a thin sheet of aluminum, they can penetrate the dead skin layer, potentially causing burns. They can be lethal depending on the radiation dose and pose a serious internal radiation threat if ingested or inhaled.[1]
>
> *Gamma rays* have high energy and a short wave length. Gamma rays penetrate farther into tissue than beta particles, but leave a lower concentration of ions in their path to potentially cause cell damage.[1]

What sort of radiation monitoring occurs in the US?
EPA reports real-time data on gross beta and gamma through their RadNet program, which is a nationwide system that continuously monitors the nations' air and regularly monitors drinking water, milk and precipitation for environmental radioactivity.

FDA and *Customs and Border Protection* (CBP) carefully screen all food products for unsafe substances, including radiological material, at US ports of entry. CBP recently issued protocols and directed their field personnel to specifically monitor maritime and air traffic from Japan.[3]

If CBP sees high levels of radioactivity in a traveler, they contact the state radiation control director who might collect a spot urine specimen, which the public health laboratory would package and ship to *CDC* for analysis.

Several *states* have their own environmental monitoring programs and laboratories, especially those states with nuclear power plants. These labs can help determine what radiologic material is present and where. EPA funded four states to build their environmental radioanalytical capability: Connecticut, Kansas, Texas, and Washington. Likewise, FDA funded five states for food safety capability: Maryland, New York, Texas, Washington, and Wisconsin.

Why do we need a laboratory if we already know radiation is present?

Simply detecting the presence of beta or gamma particles does not tell you about the radiation source (i.e. iodine or cesium) or the internal radiation dose. Similarly, simply detecting external contamination on a person's skin or clothes does not mean they were exposed internally.

A *bioassay* is an assessment of radioactive materials that may be present inside a person's body through analysis of the person's blood, urine, feces, or sweat.

Biodosimetry uses biological indicators to determine the dose of radiation that has penetrated an individual. Common indicators include the rate of decline in lymphocytes and the quantity of chromosome aberrations. It is used to assist in medical management of victims and to predict short- and long-term health effects of radiation exposure.

What is the difference between sieverts, curies, rems, etc.?

The amount of radiation being given off, or emitted, by a radioactive material is measured using the conventional unit *curie* or the International System of Units (SI) *becquerel*. The radiation dose absorbed by a person (that is, the amount of energy deposited in human tissue by radiation) is measured using the conventional unit *rad* or the SI unit gray. The biological risk of exposure to radiation is measured using the conventional unit *rem* or the SI unit *sievert*.[4]

Should I be concerned about radiation exposure?

No, the average US citizen does not need to worry. The US continues to monitor for elevated levels of radiation and radioactivity, whether at ports of entry, in the air, in rain water, drinking water or food. To date all of the results were expected and the levels detected are far below levels of public-health concern.

References

1) CDC. Glossary of Radiation Terms. http://emergency.cdc.gov/radiation/glossary.asp#r. Accessed 3/29/11.
2) EPA. Commonly Encountered Radionuclides. http://epa.gov/radiation/radionuclides/. Accessed 4/6/11.
3) CBP. Statement Concerning Radiation Monitoring of Travelers, Goods from Japan. http://www.cbp.gov/xp/cgov/newsroom/news_releases/national/03172011_6.xml. Accessed 3/29/11.
4) CDC. Radiation Measurement. http://emergency.cdc.gov/radiation/measurement.asp. Accessed 4/6/11.