We are the doctors, and other experts of nuclear technology, theoretical physics, and medical physics in radiation oncology group at The University of Tokyo Hospital. Our team has been organized to share the knowledge of medicine regarding the accident in Fukushima of nuclear power plants.

I am Keiichi Nakagawa, who is a director in radiation oncology at The University of Tokyo Hospital. I express deeply sympathy for the stricken people in Tohoku and Kanto massive earthquake area. I'd like to make a tweet on current leak at Fukushima nuclear power plants.

【March 15】
Radiation itself is a light (a photon) or a particle which has an energy allowing to go through materials. If we receive it too much, it causes substantial damages on body and its gene. We call an ability to emit a radiation "radioactivity", and call a material embedded radioactivity "a radioactive material".

Under current accident of nuclear plants, radioactive materials leaked out. It looks like pollen flies spread in the air. The difference is that this material has the radioactivity. Suppose what is effective to prevent pollen from coming into your house. First is to flap away it from your clothes before inside your house. To shut the windows to seal is also effective. In contract to pollen, of course, a radiation can go through walls and windows; therefore there is no way to prevent all radiations coming into basically. We can easily understand that in case if you breathe radioactive materials into you body, it would make a serious situation.

We call an exposure receiving inside body "internal exposure". It is more dangerous than "external exposure" which comes from outside body. The main reason is that we can wash out those materials outside body while we cannot do it in case inside body. Just like pollen, when you go home with much amount of radioactive materials, it is important to flap away them from your clothes and wash your body.
There was an opinion that closing the window is not useful. This opinion is totally misunderstanding. Closing the windows is greatly effective. If there are something to prevent, radioactive materials cannot come in, and also the radiation reduces before it

reaches in your body.

In the first place, the debate of whether there will be radiation exposure or not is meaningless because we are all "exposed to radiation" just by living in this world.
At the world average, we are exposed to 2.4mSv (millisievert) of radiation a year.
(Radiation emitted from atmosphere, ground, space, food and so on is called natural radiation.)
"mSv" reads "millisievert." "Millisievert" is a unit to measure an impact radiation has on human body. "Milli (m)" is 1,000 times greater than "micro(μ), so 1mSv = 1,000μSv.
Natural radiation exposure varies among countries and regions. For example, at Ramsar, Iran, people are exposed to 10.2mSv a year. That is 10,200μSv. There are also areas around the world with low exposure.

【March 16】
Yesterday (March 15, 2011), in Tokyo, radiation dose of approximately 1μSv per hour (1μSv/h) was observed. How does this compare to the natural radiation we receive from atmosphere, food and so on ? If you stay in Tokyo with this situation for 100 days, you receive 2.4mSv = 2400μSv. In other words, one would be exposed to the dose three times greater than normal level. Now, how much medical impact does such a radiation dose have?

The lowest radiation level that is detectable clinically is said to be 200mSv(millisievert), i.e. 200,000μSv(microsievert). Symptoms start to appear at 1,000mSv, or 1,000,000μSv(microsievert).
As an extreme example, the probability that one would die within 60 days is 50 % if one is exposed to 4,000,000μSv（microsievert）.
At lower radiation doses, there is no symptom and abnormal finding is negative, but the risk of one's developing a cancer does increase except for when the accumulated dose is less than 100mSv (millisievert) . In such a case, the risk of having a cancer does not increase. And even when the risk increases, the increment is about 0.5% at the accumulation of 100mSv.

The leading cause of death in Japan is the cancer, whose ratio is the No.1 in the world. One of two people gets afflicted by a cancer. That means the risk of getting a cancer, normally 50 %, becomes 50.5% if one is exposed to 100mSv of radiation. Smoking is more dangerous. If the current level of 1μSv per hour continues, the accumulated radiation reaches 100mSv in 11.4 years and you realize how little the risk is.

Now, if we compare amount of radiation to hot water in a bathtub, "x millisievert per hour" would mean "how strongly the hot water flows out from the faucet." The higher the value, the more intensely the water is gushing out. And the amount of water accumulated in the tub is expressed as "x millisievert."

To continue the same metaphor, it is like 100 mV (millisievert) of hot water accumulated drop by drop over 11.4 years. Note that the same amount of hot water that gushed out in just a few minutes and that accumulated slowly over 11 years, in case of radiation, have very different levels of impact on a human body.

DNA of any living thing starts to repair immediately even if it is damaged by radiation. And if the "dose rate" is 1μSv/h (micro sievert per hour), damaged DNA would repair mostly, and therefore it has little medical impact. Of course, that does not mean we can say there will be absolutely no impact in the future.

【Answer to questions】

(1) If you are pregnant, please note that the fetus in the first four months of pregnancy is most affected by radiation. It has been shown that accumulation of less than 100mSv(millisievert) does not have impact on fetus after that period. Data on radiation protection for pregnant women are compiled by the International Commission on Radiological Protection.

(2) The impact of radiation on a human body is equal for both external and internal exposure, and yet, internal exposure can be said to be more dangerous because once radioactive materials are in your body, you cannot escape the exposure. But, even if a radioactive material is taken in a human body, the impact of its radiation decreases while the material is excreted from the body and the radioactivity decreases naturally.

(3) You probably heard of iodine and cesium as radioactive substances which can be scattered from a nuclear power plant. The time required for those substances to be absorbed in and excreted from a human body is different depending on the form of the substance and the part of the body the substance is taken in.

At The University of Tokyo Hospital, we use radioactive iodine to treat cancer in thyroid cancer. When we use this therapy, patients' intake of iodine is controlled so that radioactive iodine would accumulate in their thyroid. (We will take up this topic some other time.) As a rule of thumb, once iodine is taken in our body, it takes about 30 days for a half of it to be excreted from our body, but the iodine radioactivity itself also decreases by half in 8 days. Most of radioactive iodine emits radiation until they leave your body. Note, however, that if it is not taken in the thyroid, most of it will leave your body within a day.